THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL.

VOL. 34. Thursday, November 4, 1926. No. 533

PUBLISHED WEEKLY.

Subscription Terms: 15s. per annum.
Foreign and Colonial, 17s. 6d. per annum.
All Subscriptions are payable in advance.

All communications to be addressed to the Editor, or to the Publisher, as the case may be, of

THE FOUNDRY TRADE JOURNAL,
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Forthcoming Events.

NOVEMBER 5.

Junior Institution of Engineers:—Ordinary meeting in London. "Steel Castings and their Relation to Mechanical Engineering," Paper by Robert Lowe.

Institution of Mechanical Engineers:—Thomas Hawksley Lecture: "Elasticity and Plasticity," by Professor E. G. Coker, D.Sc., F.R.S.

Institution of Fuel Economy Engineers:—Lecture on "Pulverised Fuel Firing for Steam Boilers," Paper by R. Jackson.

NOVEMBER 8.

Institute of Metals (Scottish Local Section):—Meeting at Glasgow. Open discussion on "Die Casting."

NOVEMBER 9.

Sheffield Metallurgical Association:—Ordinary meeting at Sheffield. "Metallurgical Furnaces," Paper by C. Nelson.

Institute of British Foundrymen.

NOVEMBER 11.

London Branch:—Ordinary meeting in London. "Considerations in the Gating and Feeding of Steel Castings," Paper by Major Rhydderch.

Birmingham, Coventry and West Midlands Branch:—Ordinary meeting at Birmingham. "Labour Conditions in American Foundries," Paper by J. T. Kay.

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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49, Wellington Street, London, W.C.2.

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Foundry Trades Equipment & Supplies Association.
Secretary: K. S. Bridges, Avenue Chambers, Southampton Row, London, W.C.1.

Coal Stoppage Troubles.

Six months of industrial upheaval finds that amorphous industry, the foundry, still carrying on with varying degrees of success. Of course, the large pipe foundries are finding the greatest difficulty, as theirs are such large-scale enterprises, usually associated with a blast-furnace plant. These apart, however, the majority of the foundries are still working, and are reasonably busy. Many have managed to reimburse themselves for the extra cost of coke and pig-iron, but others, recognising, perhaps, that their product may not quite reach their normal high standard are refraining from asking higher prices for an inferior article. Westphalian coke is just like any other coke coming from a large district. Some is excellent and some quite unsuitable for the manufacture of high-grade castings. We have had a few complaints of high sulphur content, which has increased the number of "foundry" defects and caused a certain amount of trouble in the machine shops. The efficacy of certain alkaline briquettes, either home made or proprietary articles, is well known as a reliable medium for the reduction of the sulphur content; but, unfortunately, the time-temperature factor is of such importance that no time can be allowed for its application. However, foundrymen are not easily beaten, and experiments are being made for reheating the desulphurised iron by means of independently heated receivers and the use of Thermit. Other foundries have had trouble with poor quality coke—not necessarily high in sulphur but more of the type which bluntly refuses to yield an iron of a sufficiently high temperature that it will rid itself of entrained slag and dirt. One has been particularly successful in overcoming this difficulty by the installation on the cupola platform of a tank of fuel oil suitably piped to gravity-feed into the tuyeres, relying upon the blast pressure to carry the oil well into the zone of combustion. We have heard of but few complaints of foreign pig-iron except, of course, the exorbitant price, by foundries who are accustomed to work to analysis. In our correspondence there is a complaint of a shortage of coal dust. Whilst we have had intermittent complaints, we do not believe that there exists any real difficulty in obtaining material of suitable quality.

Merger in the Swedish Iron and Steel Industry.—The four Swedish Ironworks financed by the Swedish Commercial Bank, namely (1) Fagersta Bruks A.B., (2) Horndals Järnverks A.B., (3) Klosters A.B., and (4) Gimo-Oesterby Bruks A.B., are to amalgamate. The general meetings of all four companies have already approved the scheme. The Fagersta works are to "rent" the other three companies' works.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Coke, Pig-Iron and Coal Dust.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Judging from casual remarks during conversations between foundrymen whenever they meet it would appear that the present dispute in the coal trade has served its usual purpose of enabling derelict stocks of coke and pig-iron to be absorbed by the foundry industry at greatly enhanced prices.

While owners are apparently glad to obtain coke or iron of almost any quality (approximate analysis given but not guaranteed) the man actually using them appears to be having a rough time, and in turn uses the opportunity for disclaiming any responsibility for all types of defective castings.

Quite a number of foundries are suffering a famine in coal dust; those having coal of some kind grind quantities in the sand mill, and get indifferent results thereby. For light castings, a finer quality is required if the skin is to be retained up to a fair standard of quality.

The ordinary sand mill, however, will not produce superfine coal dust whatever the quality of coal used. Of course, there are special grinding machines shown in most of the foundry supply catalogues stated to be capable of giving a superfine product, but are they?

Many firms having coal of some kind but no coal dust would welcome the appearance of a complete and self-contained machine for the purpose, and it would appear a good opportunity which the foundry suppliers ought to grasp.

INTERESTED.

Semi-Steel Cast Iron.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Semi-steel cast iron or steel-mix iron for cylinders for Diesel and superheated steam engines has apparently passed out of the experimental state and is now being used extensively.

The writer's experience has been satisfactory in the securing of a close-grained metal giving high tensile and transverse tests with a satisfactory deflection.

A question has arisen regarding the effect of steel in the metal with regard to the coefficient of friction, and any data will be extremely valuable.

The appearance of the semi-steel during machining is much brighter than the ordinary cast iron used for cylinder castings. The wearing qualities of semi-steel appear to be a matter of vital importance, and on this depends its acceptance or rejection by many of the consulting engineers.

The percentage of steel in the metal under consideration is from 17½ to 20 per cent.—Yours, etc.,

"CYLINDERS."

The Obligation of the Ironfounder to the Diesel Engine User.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—The title of your leader of last week, "The Mutual Obligation of Foundrymen," tends to lead readers to believe that it is a criticism of my recent Paper before the Diesel Engine Users' Association entitled "The Obligation of the Ironfounder to Diesel Engine Users." If your leader is a criticism of my Paper, then I beg to point out the almost wholesale manner in which my subject-matter has been maltreated.

In the first place you say "It is based upon an incomplete survey of the industry as a whole." Surely that is an uncalled-for comment, considering that the title of my Paper confines the arguments to those foundries supplying or who ought to be supplying Diesel engine users. My arguments were based upon foundries which *have* "cupolas of adequate capacity and cranes capable of removing the finished casting."

I am in no way perturbed by the general "and not particular" criticism constituting your leader. My efforts to get engineers to pay better prices for castings, to make their castings in their own foundries, and to search for the right cast iron for their engines will continue. Many foundries in the marine trade are to-day in a deplorable condition through lack of scientific methods, and, consequently, the power to command good prices for standard materials.

Our foundries and our foundrymen are as good as those of any other country; get their metals under scientific control, and their products are second to none; leave them as they are in the majority of foundries in that trade, and we are throwing away a great opportunity which affects not only British castings, but British engines.

You speak of "washing dirty foundry linen." There is none. The marine foundry trade has been starved of both money and knowledge—and whilst your survey of "the industry as a whole" may show the direct opposite, I spoke of my experience of one branch only of the industry.

Mr. Ford's recent book contains a passage which might well be absorbed by many who are delaying progress in cast iron to-day in similar manner to those who did likewise in the case of steel many years ago. The passage is as follows:—"There are always two kinds of people in the world—those who pioneer and those who plod. The plodders always attack the pioneers."

Competent foundrymen generally are pioneers all day and every day; the plodders are to be found more often in managerial positions, and, as I have said, are starving foundries of both money and knowledge. I speak throughout of foundries coming under the heading of my Paper.—Yours, etc.,

HORACE J. YOUNG.

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—Mr. Young's Paper and the discussion thereon, reported in your issue of the 28th inst., make interesting reading. I am in agreement with Dr. W. H. Hatfield, who suggested that Mr. Young was inclined to exaggerate with regard to the production of suitable irons; that satisfactory castings could be made for Diesel engine purposes; and that the better equipped foundries in this country would have no difficulty in complying with the requirements of Diesel engine practice.

For many years it has been my good fortune to know intimately many of the principle foundries in this country, and I can assure Mr. Young from personal experience that there are a very large number of foundries in Great Britain and Northern Ireland which are properly controlled and a number of these are quite capable of turning out suitable Diesel engine castings with regularity of results. To make any other suggestion is to ignore the progress made in metallurgical knowledge during the last 20 years and to cast a slur on both the chemist and the practical man who have become able and experienced metallurgists and who produce with regularity sound castings with good tests and few wasters.

Such men work hand in glove with the pig-iron makers to their mutual advantage, and just as good castings—even for Diesel engines—are made by foundries in this country as anywhere on the Continent (Mr. E. W. Johnson's remarks are sufficient proof), whilst leading Americans have admitted—in some cases publicly—that we are far ahead of them in the tests and quality of castings produced in Britain because we have a greater knowledge of details.

Naturally there are foundries which have not advanced, but it is unfair to take these as representing the best practice and hold their castings up to ridicule as representative of the scores of thousands of tons of high quality castings annually produced in this country.

The daily practice of some of the largest and most successful foundries in this country could not be materially improved, everything being standardised and carefully controlled by fully qualified men experienced at their job. From the receipt of pig-iron and coke to the dispatch of finished castings after severe tests, every operation is systematically controlled by laboratory and test house, and the production of up to 2,000 tons of castings per week goes on like a well-regulated clock. The very atmosphere of such a foundry is an intellectual tonic. They exist in England, and their products are exported against foreign competition. They are a standing monument to British organisation, and are "properly controlled" establishments, both practically and scientifically.—Yours, etc.,

E. ADAMSON.

18, York Street, Sheffield.
October 29, 1926.

The International Foundrymen's Convention at Detroit.

The Tour of Overseas Foundrymen under the Auspices of the American Foundrymen's Association.

BY OUR SPECIAL CORRESPONDENT.

Though the arrangements for a tour such as this, including as it did representatives of 11 different nations and official visits to nine different cities, bristled with formidable difficulties, they were overcome by exceptionally efficient team work, and the tour cannot be considered other than a brilliant success from whatever point of view it is regarded.

It is a splendid tribute to the organising ability of those who arranged it, and those who took part in it desire to record their appreciation of the work on this side of Mr. Vincent Delport, of the President of the Association, Mr. Vincent C. Faulkner, and of all others concerned.

The Delegates found themselves met with welcomes at every station; cared for at every end and turn; their convenience studied and their transport provided. Whilst the male members were making researches into American metallurgical methods, their wives were being entertained by the ladies of the local committee in each of the towns visited. They were motored to country clubs. They were shown over magnificent buildings and mammoth "stores." They were fêted and lunched, and petted and made much of. Their accents and their frocks were admired, and the only complaint that ever arose came from fair Americans, whose regret was that in some cases there were not enough Overseas Foundry ladies to go round!

Your correspondent knew but little of the members of the deputations, other than the British, until they were met on board the "Lancastria" at Southampton, though a few of them, including Signori Ratti and Rocca (the former the nephew of His Holiness the Pope), certainly travelled down from London.

The Start from London.

It was a gay group of wearers of a button inscribed "I.F.C." that assembled on September 11 on Waterloo platform to set forth across unknown seas to discover industrial America.

Mr. W. B. Lake, of Messrs. Lake & Elliot, of Braintree, was being seen off by his wife and family, and agreed to be placed in the care of a sedate and responsible member of the party.

Mr. J. M. Primrose, of the Grangemouth Iron Company, Falkirk, was there with a smile and Scottish accent, which he was justifiably confident would get him anywhere.

Mr. and Mrs. H. Winterton (Messrs. Wm. Cumming & Company, Limited, Glasgow, etc.) smiled cheerfully with Mr. and Mrs. Frank Russell (General Refractories Company, Limited, of Sheffield), determined to brave together the terrors of the deep waters of the Atlantic, and the iced waters of the United States.

Mr. S. H. Russell, Junior Vice-President of the I.B.F. (Messrs. S. Russell & Sons, Leicester), was there, prepared to see it through to the end, and the Clans from the North were represented by Mr. and Mrs. H. D. Campbell (Messrs. Shaw, Glasgow, Limited). Mr. T. H. Gray (Messrs. Thos. E. Gray & Company, Limited) joined the party at Southampton, as did Mr. William Jolley, of the Metropolitan Vickers Electric Company, Limited, Manchester. Mr. and Mrs. E. Longden (Messrs. J. H. Hetherington & Sons, Manchester), Mr. C. F. Atkinson (Messrs. Wilsons & Mathieson, Limited, Leeds), Mr. F. Blackwell, of Messrs. the Davis Gas Stove Company, Limited, Luton, and Mr. and Mrs. J. A. E. Wells (Messrs. Edgar Allen & Company, Limited, Sheffield), were discovered later, having reached the boat by various and devious means.

"Scotland Aye."

Last, but not least, "the heid o' the Clan Cameron," Mr. John of that ilk, and Mrs. Cameron (Messrs. Cameron & Roberton, Kirkintilloch) were discovered in the hotel in Southampton, so that the British party was fortunately provided with its immediate Past-President as its leader, and happily one who more than rose to every occasion, and whenever called upon, spoke adequately for the whole party, British and foreign alike, with a sincerity and grace that was appreciated by every hearer, and particularly by the Americans.

Mr. Vincent Delport, the European representative of the A.F.A. Committee on International Relations, to whom the success of the trip is to be largely attributed, and to whom every thanks are due for his forethought, patience and industry in getting the company together, was kind enough, with his wife, to accompany it to Southampton, along with the President of the I.B.F. and Mrs. Faulkner.

Messrs. John Shaw and Thomas Firth, Junr., of the Brightside Foundry & Engineering Company, Limited, Sheffield, left England on the "Berengaria" on the same day, so that the party did not see them either before their arrival at Detroit or after leaving that city a week later.

Messrs. Frank Russell and Harry Winterton were also accredited as Official Representatives of the Refractories Association of Great Britain, so that, including Mr. T. H. Gray, the Refractories Industry was well represented, and showed its desire for progress and a broader experience.

Under Expert Guidance.

The party was under the guidance of Mr. R. H. Baker, of Cook's, who accompanied it to New York, and to whom very best thanks are due—in fact, Messrs. Thos. Cook & Son carried through their part of the entire arrangements with credit to themselves and satisfaction to practically everyone concerned.

Mr. Attwater, of Cook's, who had done most of the research and clerical work in connection with the trip, also accompanied the party to Southampton, and deserves high praise for his work, it being remembered that the Delegates included 100 persons, British, French, Italian, Belgian, Spanish, Swiss, Swedish, Norwegian Dutch, Luxembourgian, and German, who travelled on no less than twelve different ships to form one group in New York and travel together over two thousand miles in the States.

Mr. A. S. Collins stood by for the Cunard Company to see that all documents were in order, and was fortunately handy to invite the crowd to dinner at the G.W. Hotel, Southampton, when it transpired that the "Lancastria" had not turned up from Le Havre as early as expected.

A Municipal Farewell.

Arrangements had happily been made for the Mayor of Southampton to address the Delegates on board the R.M.S. "Lancastria," and to wish them "God-speed" on their journey.

THE MAYOR (Mr. Silverman) said that he himself and his colleagues of the Corporation of Southampton felt very keenly that great advantages were to be derived by the mixing of the peoples of one country with those of another country, and that they have each much to learn the one from the other. He said that the Corporation and himself were at all times anxious and willing to do all in their power to encourage and support such educational journeys as those of the foundrymen, and it had been a pleasure to him to receive the invitation. He wished them a successful and instructive journey and a safe return home to impart fresh efficiency and energy into their work.

The President Replies.

MR. VINCENT C. FAULKNER, the President of the Institution, thanked the Mayor and his attendant Aldermen very warmly for having inconvenienced

themselves to the extent of visiting the boat at so late an hour. He said the party hoped to derive great benefit from this tour, and was heartily in accord with the Mayor's opinion that nothing but good could result from the actual contact of representative industrialists of all these European countries with those pursuing similar interests in the United States. The party might be sure of a very warm welcome, and he knew from his personal experience that American foundrymen would vie with each other in demonstrating their methods without even a hint of reserve. He called upon

MR. VINCENT DELPORT, who spoke fittingly, and on behalf of the A.F.A. he said that its members who had visited Great Britain had been impressed and pleased with their reception, and were only too anxious to have an opportunity of reciprocating. He took the opportunity of giving further useful information and necessary instructions, and said he had had much pleasure in doing what he could to bring about what he expected and hoped would be a highly successful visit, profitable to all concerned.

MR. CAMERON, M. MAGDALENAT, M. GERARD, and others also spoke appropriately at a pleasant and useful little function.

Life on the Boat.

Many pages could be filled with the sayings and the doings of the party on the boat, with the story of their life for ten days, with lists of those who suffered from *mal de mer*, and those who never missed a meal, how the sweepstake on the ship's daily run was organised and grew in strength each day, and how well the whole party got on together; all of which has nothing to do with foundries, though it had a good deal to do with these particular foundrymen. Suffice it that the officers of the ship held the view that the men from the foundries were tough and hard and that Britain was not disgraced.

The first part of the voyage was over placid seas, but on Friday a great storm arose, so that the dishes from the tables in the dining room were rapidly deposited upon the floor, and few of them were available for further service. Heavy baggage fell with heavy thuds as heavy seas struck the good "Lancastria." From side to side she slowly rolled, whilst trunks and boots journeyed across from side to side of the cabins in a comic succession of incongruity. One member was hurled, surprised and awaken, to the floor, and thought for one mystified moment that he had been cast from his bed. He found that was not so, for his bed had come with him, and it is rumoured that he finished the night where he lowly lay.

The food supplied to the pilgrims was good, and so abundant that Mr. Primrose was understood to remark that though the sea air did not make him hungry, he thought it would have done so if it had had time.

One of the Scotch members was understood to say that "he wis no sick this time, but the last time—och! the first part o' the voyage he wis feart the boat would go doon, but in the last part his fear was that it wouldna."

During the voyage there was held a meeting at which Mr. Cameron presided, and at which members of each of the foreign delegations spoke, their remarks being translated by those members who had more than one language in their repertoire. The object was "to get acquainted" and to learn who was who, a very useful proceeding, which entirely broke whatever ice was remaining. Each member rose and said who he was, and what he did and why, and Sr. Vanzetti, Jr., made himself very useful with his English, French and Italian.

Most of the foreign members settled down to learn as much English as the opportunity offered, and many of the British fraternised with the Americans on board, and were quite fascinated by their extraordinary methods of expressing themselves and the neat way in which some of them epitomised their views.

Professor McCormack, of the department of English at Annapolis Naval College, was rejoiced to hold court in the Aft Smokeroom and expound to a circle of delegates his views on America and Americans, their problems, virtues and failings.

The next generations of Americans, said he, will know more about distilling than all the rest of the world. They make wine, he said, of anything but old rubber hose, and they save that for gin!

Land Ahoy!

One fine morning we woke to see land again, and to meet the Statue of Liberty face to face. A wireless message was received from "The Iron Age," who asked the delegates to assemble on the roof of the Pennsylvania Hotel for their portraits to be taken; this, by the way, producing a very interesting result.

Space forbids the story of the impression made by the first views of the overwhelming skyscrapers of New York; of how the tugs push and pull the boat into dock; of the medical inspection, the counting of knobs; the solemn examination of passports and vouchers, and the not very stringent examination at the Customs, but those who have heard sad tales of Ellis Island and have feared this inquisition will be glad to know that though no less than 19 liners had arrived that same day, every possible courtesy was experienced both from officials, Custom House officers and police, and nothing was needed but a little patience. Ellis Island is entirely out of the question.

The Reception.

The first familiar face to become visible on the wharf in New York was that of our old friend Mr. H. Cole Estep, so well known to most of us. He was spotted in the crowd by Mr. Frank Russell, and these two shouted greetings across the rapidly narrowing strip of water which separated the "Lancastria" from the pier. His work in connection with the organisation of this excursion is beyond all praise, and he was to the party a very real and valued friend throughout.

With Mr. Cole Estep on the pier was Mr. Root, the President of the A.F.A., and Mr. C. H. Clamer, Mr. V. E. Minich, and others of the A.F.A. Committee of International Relations, who warmly received the members on the introduction of Mr. Cole Estep.

A Mammoth Hotel.

The delegates were quickly transported to the Hotel Pennsylvania, a most extraordinary and astounding building with no less than 2,200 bedrooms, each with its own bathroom, and from 10 to 12 passenger lifts; some of them "expresses," which did not stop until the 16th floor was reached!

Here was a group of members, including Mr. Stanley G. Flagg, of Philadelphia, a stalwart from whom much kindness was received, as will appear later; the world-known Dr. Richard Moldenke, and very many others, who took care of the party's material needs in the way of refreshments.

It is characteristic of American business men and their courtesy that the Chairman of the New York Reception Committee addressed a specially typed letter of welcome to each and every visitor, and delegates were gratified to find this waiting for them when they reached their rooms.

A Hearty Welcome.

Nothing could exceed their kindness and courtesy, and we believe readers will be interested in the actual terms of the letter, which read as follows:—

"We trust you will take this greeting as a personal one, for we express the feeling of each of us, and of all those for whom we speak when we say—'Welcome to New York, and to all of our cities in which you may set foot.'

"We know how much you have done that we might meet face to face; how far you have come, and what a large outlay you are making of one of your most precious possessions—your time. Our first desire is that your stay with us may be a happy one, and in all ways worth while.

"Many of us have lively recollections of the warm-hearted way in which you and your various associations have received American foundrymen in other years, and we can only wish that your memories of this stay in the United States may be equally bright and enduring.

"Above all, may your visit help speed the day when we as peoples get to the hearts of each other and establish lasting and unbreakable friendships.

"Faithfully and cordially yours,

"(Signed) V. E. MINICH,

"Chairman, N.Y. Reception Committee to Overseas Visitors."

A Photo on a Roof.

After registration and lunch, and the photo on the roof, followed by an inspection of the city from that great height, the members wandered round that most astonishing city, New York. Broadway, which is the street containing most of the theatres and places of amusement, is termed "The Great White Way," but this description, like everything else in the U.S.A., is becoming fast out of date, for the white lights which gave it its name have been changed to those tinted with all the hues of the rainbow, and for ever winking and blinking and coming and going. In red you read of somebody's cigars, and in blue of wonderful collars. Look again; the cigar is purple, but somebody has lighted it, and as you watch it, it glows, and may be seen to burn; what time the collars are an emerald green or a violent purple!

On Tuesday, September 21, the delegates were at liberty to visit certain foundries and factories in the neighbourhood of New York, and many of them availed themselves of the privilege, some getting through quite a large mileage in the day. There was a great choice of works available for visitation, and the delegates were all scattered. Your correspondent, like many others, preferred to take the opportunity of learning a little more about New York, especially as the principal industrial districts of the United States were yet to be visited.

The Overseas Banquet.

In the evening was the banquet held in honour of the Overseas Delegates, in a huge room, its walls draped with the flags of all nationalities represented; separate tables, each seating eight persons, except for one long table which was occupied by the A.F.A. officials and the leaders of the parties from each nation.

On the left of the President (Mr. Root) was Mr. Cameron, and on his right was Monsieur Ronceray, of France. Mr. S. H. Russell (Junior Vice-President) was also accommodated at the head table, and the positions of the other British delegates will be seen from the photograph we reproduce on next page.

A Negro Jazz Orchestra.

On the entrance of the diners the negro jazz orchestra sang the whole of the National Anthems one after the other, whilst all in the room remained standing.

A charming address of welcome to America by MR. A. V. ROOT followed. This was translated into French and German by a professional linguist, thoughtfully provided, and this, be it noted, sufficed, for all the Italians and Swiss, etc., seemed to know French, and the rest of those who did not speak English spoke German.

During the meal the coloured band walked round and round the room, in and out of the tables, singing loudly, and with beaming smiles, all kinds of coon songs and American melodies. Water, iced or otherwise, was here discovered to be the national beverage, not even ginger ale or lemonade is drunk at public dinners, and yet our American cousins are eloquence itself.

Eloquence on Ice.

It is hard to imagine to what heights their oratory would soar if their throats were lubricated and their imaginations stimulated in the British fashion. One result of this custom is that toasts are not drunk and responded to in the British fashion. Instead a speaker rises to deliver a certain message, it being held inappropriate to quaff a health in water.

MR. ROOT, who mentioned that there were over 200 people present, introduced Mr. J. A. Penton, an honorary member of the A.F.A. Mr. Root spoke highly of him, and said that he had given his name to and presented a medal for the encouragement of research.

MR. J. A. PENTON said that the foundry industry was to America of maximum importance, and that visitors were welcome to practically every foundry in the country. Americans, he would say, would go out of their way to make such visitors as the delegates welcome. He was delighted to be present at so remarkable a gathering as this, and said it was such international reunions that would remove from the future all possibilities of further conflicts like that which had recently shaken the entire world.

No Dreams of Conquest.

Speaking from a wide international knowledge, he could say he was convinced that there was no nation in the world that harboured to-day a single war-like thought or dreamed of conquest. Each desired only to be left in peace to work out its own salvation, and there was no real foundation for international suspicion and mistrust.

On the other hand, the fact is that the peoples of the world are at last beginning to realise and appreciate the difficulties which other nations have to face, and the problems they have to solve, and there is a desire to know more about the other party.

There has been a gradual drawing together of all, more particularly of all those who speak the English language, and it was inconceivable that in any future world conflict the United States of America could ever remain outside, and equally inconceivable that they could take sides against any other English-speaking nation. Mr. Penton's speech was one of the best of the tour, and was heartily applauded by all the nationalities present.

From Small Beginnings.

MR. COLE ESTEP said he hoped this was only one of a long series of international meetings of foundrymen. Did those present know that this magnificent gathering was the result of a conversation held in an upper room of a hotel in Birmingham, where it was decided to make an effort to hold such international meetings every three years? He gave the Overseas visitors a very hearty welcome, and said with what pleasure he looked back to the time he himself spent in England. He introduced M. PAUL ROPSY, President of the Belgian Foundry Association, who spoke in excellent English. Amongst other appropriate remarks, he said it was a joy to be present on this occasion and to meet old friends again. He was much impressed with the warmth of their welcome, and was looking forward to a most interesting tour.

M. H. MAGDALENAT, Vice-President of the French F.A., spoke fluently in French in the same strain, and was followed by DR. GEILENKIRCHEN, of Dusseldorf, who spoke quite well in English, and said that in Germany the foundry trade was very bad, and consequently there were many foundrymen who would have liked to have come but had been prevented by circumstances. However, as many as possible had come, hoping to learn a good deal.

He had been taught that industrial secrecy was a sign of weakness, and as there was no secrecy here in the United States it seemed they were strong in their strength.

MR. COLE ESTEP then introduced Mr. Cameron, immediate past-President of the I.B.F., remarking that it seemed curious that every British delegation that visited the United States should have a Scotchman as its spokesman.

MR. JOHN CAMERON said his being there as spokesman was an accident, though it was not an accident that he was Scotch. The gentleman who should have occupied his position and spoken for the British Delegation was one who was very well known to many of them there present, and it was a matter of very great regret to all who knew him that he was unable to be with them and to benefit from the Convention and the tour. He referred to their esteemed President, Mr. Vincent C. Faulkner, the Editor of THE FOUNDRY TRADE JOURNAL. (Cheers.) As he looked round he felt that Great Britain had made a great mistake in the composition of this deputation, for with the exception of Mr. S. H. Russell, who would be President in two years, and a few others, the delegates were mostly old men, whereas the Americans, Belgians, and others were represented by young men like those near him, and the deputations from the other nations contained also a very fair proportion of really young men who would benefit more than others from this journey across the ocean. He regretted that greater advantage had not been taken of this opportunity of completing the education of those who would follow in our footsteps, but feared that the industrial situation was largely responsible. A great charm of these gatherings and of such conventions lay in the number of new friends one made and of new friends we had, during the

Banquet Offered by the New York Reception Committee to the Delegates to the Second International Foundrymen's Congress.

voyage and since landing, already made many, and of many different races.

Italy—Industrious and Progressive.

MR. COLE ESTEP then introduced Sig. Com. Ing. Vanzetti, of the Milan Steel Foundry, Milan, with a few graceful remarks about his country, its beauty, and its storied past.

SIG. CARLO VANZETTI spoke excellently in French and with true Latin enthusiasm. He accepted the compliment that Italy was the home of music, of art and of beauty. We were to spend three weeks in America and had only had two days, but that was enough to enable us to see that America was the home of hard work, and he could assure them that the same was true of the Italy of to-day, and that a new and glorious spirit of progress inspired her foundrymen, who were grateful for this invitation and determined to spare no pains to profit from it. He shook hands with the President very warmly, amidst delighted acclamation.

DON JOSE ITURRIOZ, of Ajuria y Aranzabal, Victoria, Spain, speaking for Spain, echoed in French M. Vanzetti's thanks, his modest manner making an excellent impression.

A Long and Expensive Voyage.

MR. SIXTEN NILSSON gave thanks for Sweden in similar terms. He added that it was a long and expensive voyage, but he was confident that it would be worth while, and he could not thank their hosts too much for their cordial hospitality.

MR. T. J. BRONS, official representative of the Co-operative Society of Dutch Iron and Steel Founders, Appingedam, spoke for Holland. He used the English language with an excellent accent. He said he was glad to be present at such a gathering, and to have an opportunity of saying so. Business, he regretted to say, was bad also in the foundries in Holland, and for the sake of those who had been prevented by financial considerations from attending the Convention, he had a hope that it would next time be held in Europe, so that poorer European foundrymen would be able to be present. (Laughter.)

"Off to Philadelphia in the Morning."

This banquet terminated the proceedings at New York, and next morning the delegates left in special parlour cars by the Pennsylvania Railroad at 9 a.m. "Eastern Standard Time" (which means 10 a.m. by Daylight-Saving Time—another British invention), for Philadelphia, *en route* to Buffalo, Niagara Falls and Detroit.

Black Porters.

Porters are rare birds at the stations, because of the almost universal habit of "checking luggage through," that is to say, the porter at the hotel is told that the bags are ready, labelled with destination. One of his emissaries fetches them from the bedroom, and they are not seen again until the journey's end, when they may be obtained from the baggage room. Such porters as were visible had black faces, and red and blue uniforms, and one did not feel in them quite the same immediate confidence that one gives to a porter at home.

The day, though young, was hot, and the pilgrims were hotter. Each had been told the number of his carriage and had no difficulty in finding it because of a black and white label exhibited in the space provided. He found a long saloon with a green carpet, and on each side green upholstered easy chairs swinging round at will on a central pivot.

The windows had a blind which remained permanently about one-third of the way down, and irritated those who love air, but comforted those who loved coolness. The windows are double, but both sashes will be raised by the negro attendant on request, and a wire screen is there to be let down, if desired, to fill the space. The coloured men did not strike us as being any too polite. They mean well, however, and do not appear to be the greedy tip-snatchers some of us had been led to expect.

A Huge Black Engine.

There was time to inspect the locomotive which had the task of hauling this heavy train. The engine was tall, black and rough. It towered far higher than expected. It was 38 yards long with its tender, and weighed 300 tons without it. It was rude, simple, tractive, epitomised, and nothing had been spent on anything that did not matter or help to pull. There was a poor rough finish on both castings and forging work, particularly the latter, and it is safe to say that no English company would turn out such a job.

The American is well aware of this lack of finish, but he replies, "What does it matter?" and the railway companies are not prepared to pay for polish.

A similar point of view might be applied equally to motor cars, which, curiously enough, are splendidly finished throughout the United States.

An Uninviting Landscape.

The view from the carriage windows was at first flat and dull, the observer being immediately struck by the untidiness of everything, by the number of poles of every kind, shape, size and condition which has one end in Mother Earth and the other in the air, no two of which appear to be at the same angle. There are acres of waste land, a good deal of it marshy, and most of it unfenced. Everything in this district seems rough, unfinished and temporary, and it appears that a tremendous amount of development is still possible quite near to New York.

Travelling is none too smooth, and the noise is incessant. It is hard to escape draughts, and it was felt that life in a Pullman was not a bed of roses.

Drinking from an Envelope.

Soon thirst came. Some were provided; the Scotch, generally speaking, maintaining their national reputation. The ebony-faced gentleman was appealed to, and with grunts and in dumb show indicated a small white metal tap at the side of the corridor. This bore the welcome words "Ice Water." But how to drink it? No cups, no mugs. Ah! a bright spirit observed a peculiar container filled with special envelopes guaranteed "watertight and waterproof." These made excellent drinking cups, and were then thrown away.

Railroad Comparisons.

It was interesting to note that the rails were all flat bottomed, laid directly on the sleepers, without chairs or keys, and simply held in place by rather random-looking dog spikes. The sleepers were poor and rough as compared with those in use on English main lines, and the track generally is such that if it were part of a siding in England the railway company's shunting locomotives would not be permitted by the loco department to pass over it! Here in the United States trains of 2,000 tons in weight are hauled over such tracks at 65 miles per hour by engines weighing 300 tons—an extraordinary commentary on the conservatism and lack of mental elasticity of the diehards who control our railways, and do so little to support our enterprising traders, and so much to make their lives a burden.

The F.B.I. might do worse than organise a visit of English railwaymen to inspect the railroad systems of America.

The greater proportion of the houses seen from the train are built of wood, known as shingles, with a roof of the same material very often painted green. They seemed to be dumped down indiscriminately on any piece of waste land with fences neither front nor back, seldom a garden, and a rough track leading to the nearest road—but there is always a Ford!

The Abundance of Motor Cars.

The works passed had an untidy appearance, but were noteworthy for the large numbers of motor cars filling their yards and the roads and waste lands around.

Each works is provided with a circular tank higher than any other part of the buildings and with a coneshaped roof, in many cases the tank being raised direct from the ground level on legs of steel girders. Inquiries elicited that the purport of these tanks was to supply water for "sprinklers," which are fitted compulsorily, and are calculated to deal automatically with any outbreak of fire.

The events at Philadelphia and during later stages of the trip will be dealt with in our next and subsequent issues.

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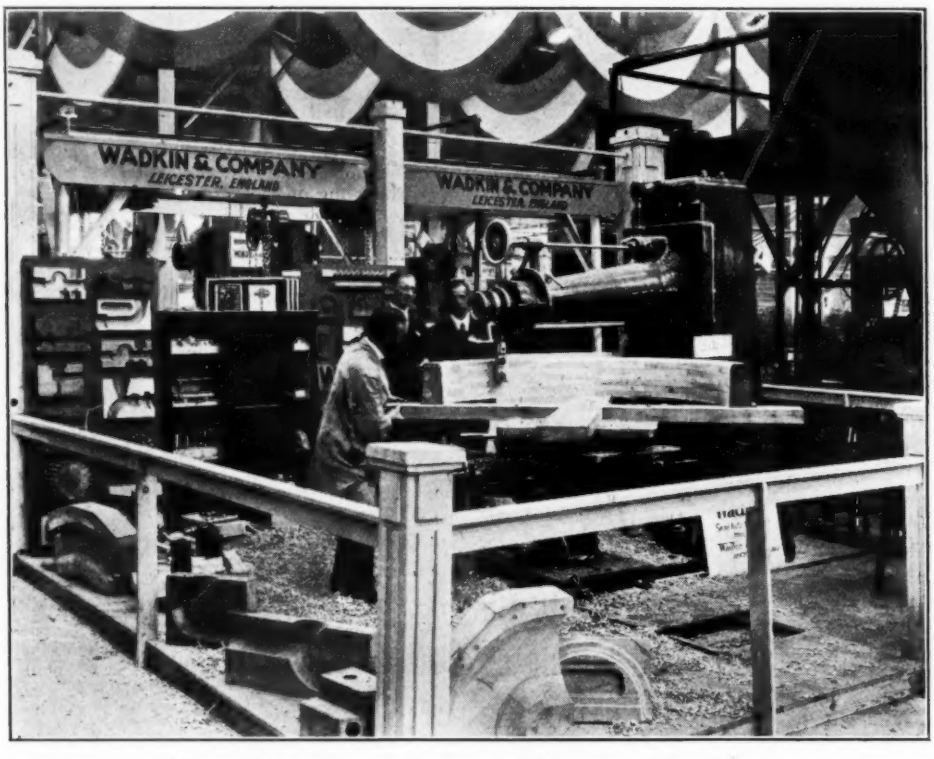
A British Exhibit at the Detroit Foundry Exhibition.

It is pleasing to note that Messrs. Wadkin & Company, of Leicester, who exhibited at the Exhibition held in connection with the American Foundrymen's Association Annual Convention at Detroit, was exceptionally well received, and good business has been done. They had on view their semi-auto wood milling machine, a photograph of which is shown below. It will be seen that demonstrations are being given of a practical nature, showing the capabilities and wide range of work the machine will operate.

This all-British pattern-making machine caused a considerable sensation. The Americans were quick to note that it was one of the most labour-saving tools exhibited, and indeed were most appreciative of its sterling qualities. It was shown in operation at frequent intervals upon varied sizes and shapes of patterns and core-box work. Many



A BRITISH EXHIBIT AT THE DETROIT INTERNATIONAL CONVENTION.

of the complex operations, which were performed in a few minutes upon the machine, would have taken a skilled pattern-maker many hours to do by hand. The work is turned out in such a condition that a rub with fine sandpaper is all that is necessary.

We are given to understand that the kind reception accorded to the representatives of Messrs. Wadkin & Company so convinced them of the wide field for their pattern-making machine that they propose showing at the next Convention. It is most encouraging to learn that notwithstanding the heavy cost of freightage and import duty, they are able to compete so successfully in this branch of the foundry equipment industry.

This machine is, indeed, the universal milling machine of the pattern-making industry, having all its motions under hand and power controls, and fitted with scales and micrometer feeds to facilitate the production of the most accurate and intricate work.

The semi-auto wood miller embodies in its construction a number of mechanical conveniences and advantages. It is an exceptionally simple machine to work, and after the operator has gained a little experience, it need never be idle in any pattern shop.

The cutter head is mounted on ball bearings, and contained in a revolving head attached on an arm, which arm is carried from the main column of the machine. The spindle chuck is bored morse taper and screwed to take cutter holders, boring bars and the varied equipment used in the machine. The cutter spindle can be operated either horizontally or in the vertical position according to the nature of the work being performed, and is arranged to revolve at varying speeds up to 4,000 revs. per minute.

The arm carrying the cutter spindle is raised and lowered on machined slides from the main column by power feed and a hand feed motion is provided for minute location of the cutter. The arm and its mechanism can be raised to a height which will bring the cutter spindle, when in the horizontal position, to a distance of 24 in. from the top of the table.

The cutter is capable of being quickly reversed by means of a hand-wheel on the capstan head and by giving a partial turn of this hand-wheel the spindle may be started, stopped or reversed at will. All the controls necessary for operating the head and the rising and falling motion of the arm are placed in a centralised position convenient for the operator. The driving clutches are mounted inside the main column, and the drive is effected through a three-speed totally enclosed gear box placed on the machine base plate. All the gearing in the gear box is of steel, with machine-cut teeth, and the controls are definitely located by means of ball plungers. The gear shafts are mounted on ball bearings.

The work table, which is 35½ in. × 32 in., is mounted on very substantial slides, and the whole table and table body, together with the compound slides, are mounted on anti-friction rollers for travelling along foundation rails. The total movement of the table bodily along the rails is 7 ft. 3 in., the rails themselves being 10 ft. long. The longitudinal traverse of the work table is operated by the large hand-wheel actuating a threaded screw, giving a total movement of 36 in., and by means of a split releasing nut a quick motion can be given along the ball slides. A lateral movement to the extent of 24 in. is imparted by means of a hand-wheel, operating through spiral gears. Plunger stops and dead stops are provided on the various movements for giving a definite location for the varying classes of work performed. Graduated scales and pointers are supplied, which give ready readings when setting the work.

The Mould—Its Function and Preparation.*

By J. E. Fletcher, Consultant to the B.C.I.R.A.

All metal workers in the ferrous industry, with perhaps the exception of those engaged in the manufacture of wrought iron, are dependent upon ingots or castings made in moulds, and even in this case the pig-iron and scrap cast iron used has originally been cast in moulds.

As the metal structure in the ingot or casting is primarily influenced by the character of the mould and its rate of heating and cooling during and after casting, the study of mould influence is much too important to be neglected.

The so-called simpler forms of casting, such as solid cylinders, cubes, spheres and polygonal columns, have presented some of the most difficult problems the foundryman and the metallurgist have to solve. The recent ingot investigations undertaken by the Council of the Iron and Steel Institute is a striking illustration of the difficulties which have yet to be surmounted in the manufacture of steel castings in metal moulds for the later production of forged, rolled, pressed, drawn, extruded and stamped forms.

The behaviour of the metal in the mould and that of the mould itself are complementary to each other, and must be studied together. The study of exaggerated conditions of the casting and its mould are well worth while, and are often helpful in getting clearer views of what happens in the normal cases of actual practice.

Effect of Hot Moulds.

In the first instance, suppose the mould to be made of highly refractory material possessing perfectly uniform heat-conductivity and heat-radiating properties, such that the mould can be heated to and kept at the same temperature as that of the metal poured into it.

This arrangement would, of course, result in the metal being kept at a constant temperature in the liquid state so long as the mould was kept at that temperature. Such a condition would, if continued long enough, enable gases and the lighter non-metallic induction and low-density metallic constituents to ascend to the top of the ingot or casting. At the present time metallurgists are not certain what the effect of such long period liquid condition at constant temperature on the metal would be. The nearest approach to such conditions is perhaps in the hearth of the blast furnace, where the iron lodged in portions of the well below the tapping hole may remain at temperatures above the true melting point for long periods. When such metal is tapped out it has always an abnormal analysis and structure when cooled.

If the hot mould be now gradually cooled at the same rate as the ingot, then, if the rate of contraction of the mould is the same as that of the ingot, the latter will keep in contact with the mould and the skin of the ingot will not be affected. The rate of freezing will, however, be influenced by the liquid pressure head due to the length of the ingot. The latent heat of solidification may be modified by the differences in liquid pressure, and the evolution of heat at the freezing point, being proportional to the pressure head, may be expected to modify the solidification temperature at different horizons. If the viscosity of the ingot metal is assumed to be greatest when the metal contains the maximum of gaseous inclusions the rate of solidification (crystallisation) will be greatest at the top of the ingot, where the metal density will be least. Hence if top, bottom and sides of the ingot are cooled uniformly the solidification may proceed from the top downwards.

This, of course, is dependent on the metal being composed of one constituent only, freezing at a constant temperature corresponding to the metal density at that temperature.

The influence of varying viscosity, latent heat of solidification and liquid pressure or density may be so small as to be ignored, in which case the non-cooled ingot envelope would cool at the same rate as the interior and the mass might freeze as a whole instantaneously.

The above hypothesis is, of course, based on the idea of a perfectly heat-conducting ingot metal and mould, permitting the heat flow from the cooling metal to the mould to be instantaneous.

Ingot Manufacture.

The nearest approach to the above conditions of ingot cooling in a slowly cooling hot mould is the case of a hot mass of metal solidifying round a hot core which, when withdrawn, leaves a space into which a further quantity of liquid metal may be poured. If the heavy metal mass has only just solidified the new ingot will cool slowly.

It will be remembered that Mr. B. Talbot used a feeding head on his fluid compressed steel ingots surrounded by a ring-runner-trough into which fluid slag was poured. The slowly cooling slag aided in keeping the steel in the feeder head fluid, and so helped to secure solid ingots. Similar annular feeder heads have been used in iron foundry practice for the efficient feeding of heavy castings of the anvil block type, the annular ring of hot metal keeping the inner feeder head hot and fluid. These two instances only deal with the slow cooling of the upper portion of a casting or ingot and do not illustrate our first hypothetical case where the entire casting is supposed to be slowly cooled in an ideally perfect manner.

At the other extreme, metal at or only just above the freezing temperature is supposed to be poured into a mould maintained at so low a temperature that the ingot or casting is instantaneously solidified completely, the mould and metal again being perfect heat conductors and possessing the same coefficients of contraction.

Any gases liberated during the crystallisation of the metal would either be entrapped between the crystal boundaries or would be driven to the axis of the ingot and escape along a cavity left in the axial portion to the ingot top and sway to the atmosphere. Here the metal crystals would be of minimum size—the exact opposite to our first (slowly cooled) case where the maximum crystal growth would occur.

Harmet Process.

The nearest approach in practice to these conditions is the case of the steel ingots made by Harmet in thick iron water-cooled moulds, the ingot being kept in contact with the mould by means of a hydraulic ram, the pressure being sufficiently high to squeeze out all visible gas inclusions, the central pipe portion common in ingots without feeder heads being closed up by the steel extruded by the compression from the lower and more plastic portion of the ingots. Heaton Shore, of the Willans Works, Rugby, by using water-cooled thin moulds, obtained bronze castings of remarkable soundness, fine crystal grain structure and high density.

Types of Moulds.

Between the two hypothetical types outlined above, all the forms used in practice are found, as briefly indicated below:—

(A) *Moulds constructed of Clay-bonded and Oil or Vegetable Bonded Sands.*—Sand, as representing a material of low thermal conductivity, can be used in either the hot or cold conditions, and, within limits, the rate of cooling of the casting is automatically regulated by the physical condition of the sand and its mass as related to the physical condition and mass of the metal poured into the mould.

(B) *Metal Moulds.*—The metals used for what are commonly known as chill moulds, being of much higher thermal conductivity than sand (coefficient of conductance. Quartz sand 0.0006, iron 0.14. *Richards*) conducts the heat away from the molten and cooling metal at a more rapid rate than sand, and, within limits, the thickness of the mould and its temperature at the time of casting control the rate of cooling in the ingot or casting. As in the case of sand, the properties

* A Paper read before the Manchester Metallurgical Society.

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of the metal of which the mould is made and those of the metal cast therein are correlated in very complex relationships.

(C) *Composite Moulds.*—Formed of a metal exterior and a sand interior, or of a thin metal interior and a thicker sand exterior are representative of practice intermediate between heat-insulating sand and heat-conducting metal moulds. To an even greater degree than in the cases of sand and metal moulds (A and B) the physical properties and the mass of the various components of composite mould influence the character of the metal structure in the ingot or casting as it freezes and cools within the mould.

(D) *Heat-treated Moulds.*—By heating or cooling the exterior or interior of moulds previous to, during or after casting, be they of simple sand or metal or of the composite type, rates of cooling the casting or ingot may be so modified as to produce variations in the metal structure characteristic of each type of casting and cooling control.

(E) *Moulds Mechanically Rotated, Vibrated, or Reciprocated during Casting.*—In special cases the mould may be mechanically rotated about one or more axes, or by changing its position (as, for instance, by reversing the mould end for end) during or immediately after casting so that the cooling rate in certain portions of the ingot or casting may be increased or diminished as desired, the structure of the metal thereby modified and the metal gases encouraged to take definite exit paths either to the atmosphere or to definitely arranged areas within the cooling metal mass.

(F) *Moulds Cast under Pressure or Vacuum Conditions.*—In the case of metal moulds particularly, it is possible virtually to close the upper portion of the mould and cast the ingot or casting under conditions of vacuum or gas pressure. In the former case the idea is to exhaust the fluid metal as far as possible of the gases liberated during solidification or of the gases in suspension in the superheated liquid metal before freezing begins. If the ingot is compressed mechanically so that there is complete contact between the contracting metal and the mould, the upper part of the ingot being kept fluid by external heating during the gas exhaustion period, very desirable structural properties in the ingot metal can be obtained.

Fundamental Desiderata

The six forms of mould treatment above described may be said to cover the types in either practical or experimental use, and the writer has been fortunate enough to have had actual experience in both the commercial and research senses in producing ingots or castings in the types of moulds, treated mechanically or otherwise, as cited. The experience gained has led to a recognition of the following important and fundamental points pertaining to mould design, preparation and operation:—(1) The relative heat conductivity values of mould materials and metals at various temperatures above and below the melting and other change points; (2) the shrinkage and expansion co-efficients of mould and metal in contact as controlled by temperature and composition; (3) the effects of partial or complete contact between the metal and mould immediately followed casting and later; (4) the relative thicknesses of mould and metal; (5) the desirability or otherwise of venting mould surfaces and the correct position of vents as demanded by the casting design; (6) the effect of slow and rapid filling of moulds as seen in the character of the casting skin, pouring speed values; (7) the effect of liquid pressure head on the rate of cooling and on the behaviour of the mould with respect to venting, distortion and later contraction; and (8) the causes of surface tears or fissures in the skins of castings and moulds.

It will be readily understood that many points of theoretical interest arise during the study of the mould and its design. There are opportunities for research in scores of directions, and every physical constant accurately determined will help in the complex study before us. But, as in so many departments of industrial metallurgy, the practical use of theoretical deductions lies in the commercially useful application of admittedly valuable discoveries in the realm of pure science. It is not easy to translate a theoretical deduction in terms of £ s. d., and many test-piece research results have failed when the test-piece had to be measured in feet instead of millimeters, and in tons instead of grammes. Nowhere is this truer than in the foundry, the cemetery of many cherished theories, strangled in that slaughter-house of ideals—the mould.

Whether a pattern represents a casting of good or bad design as viewed in the light of metallurgical laws, the mould is the reverse copy of the casting, and is the instrument of good or evil, and the moulder is often the unconscious tool of the designer who has put his metal in the wrong place or of the metallurgist who has indented a mixture or an alloy which either pulls or draws, is naturally porous or segregatory in its character, or is not fluid enough at the temperature available in the melting furnace to produce a perfectly formed casting.

The writer has been for years in the maelstrom of steel foundry control, and knows full well the difficulties of the mould problem where, owing to the high steel-temperature, erosion of the sand has to be combated by hard ramming, whilst, at the same time, hard ramming often destroys the gas-permeability of the sand and prevents free contraction of the steel when solidifying between projecting shoulders or ribs in the mould.

He is also conscious of the difficulties experienced in the designing and day by day use of metal moulds for ingot and other casting production. The rapid deterioration of heavy moulds by erosion, growth and distortion of the mould metal, together with the fissuring of the surfaces in contact with the molten metal are the bane of many a steel caster's existence, especially in these days when the utmost length of mould life is sought.

The real attempts now being made to grapple with these difficulties are now rightly demanding the aid of the experienced metallurgist and foundryman, together with the mould designer. In metal moulds, not only must the composition of the mould metal be correct chemically, but its physical structure must be suitably homogeneous and stressless before going into use. What this means in a cast-iron mould for, say, a 60-ton steel ingot can be imagined. The anxiety of the mould maker when casting such huge moulds and of the steel maker when using the new mould for the first time is known only to those responsible for the good quality of such expensive moulds and ingots.

The Sand Mould.

The call for castings in iron and steel of better finish and greater solidity, to meet the demands for safer and stronger material, is compelling the foundryman to look to his sand mould. The cost of moulding sand and of mould renewal is a serious item in foundry costs to-day, and the temptation to use as little virgin sand and as much spent or floor sand as possible is great.

One of the most important mould problems is therefore that of testing the moulding sand supplies, especially as many of the older sand quarries are denuded of their best sands, new quarries in untried areas being from time to time opened up. It cannot be questioned that many old experienced foundrymen use well worn tests which give valuable clues to the qualities of a moulding sand. To a purely scientific worker the rubbing of a sand sample on the handle of a shovel to test the clay content, the hand-squeezing and rubbing tests to gauge the degree of "velvetyness," strength of bond, openness of texture (permeability), and ability to sleek well, appear primitive and crude. So do the shovel tests made on a sand heap when adding the necessary water for adhesion, and the sieve tests on spent sand to test out the "dead" silty sand content.

In a jobbing foundry where no two jobs are alike, and where the mixing of facing sand for greatly dissimilar castings must be varied to suit the particular requirements of each, standardised methods are difficult to carry out.

Sand Testing.

The American Foundrymen's Association has done excellent work in the direction of sand testing for grain sizing, permeability, bonding strength, etc., their mass production foundries demanding uniformity of sand conditions and pro-

viding opportunities for using standardised sand-testing methods. Their sand supplies are much more variable in quality than ours, and, as the sands are generally more deficient in natural bonding clay, they require clay additions and much more careful treatment than British sands.

But experience here is rapidly showing that more must be known about our virgin sands and fireclays. Their geographical and geological positions must be nationally tabulated so that each foundry district may know the quality and quantity of the deposits.

The foundryman must know the scientific meaning of grain grading clay bond values, porosity and permeability, by being able to compare practical or workshop methods of measuring the quality of the moulding sands he is asked to use.

The writer does not purpose here describing the type of sand tests recommended by the American Foundrymen's Association, and which are generally similar to those used in the research laboratories in this country. These tests are carefully described in the proceedings of the A.F.A. and are now well known.

To become a useful investigator of moulding sands, the subject must be tackled whole-heartedly and with the zeal of an enthusiast, for the ground to be covered is much more extensive than would appear on first sight.

Ruskin, in his "Ethics of the Dust," dived into the hidden meanings of the disintegrated rock fragments, and revealed the gems in the dust heap. The subject fascinated him. No sand investigator can do much good unless he becomes fascinated by his subject—for without that enthusiasm which generates patience the lessons which the fellowship of minute particles of sand, silt and clay can teach, are lost. Routine testing without vision is always "boring" to that investigator who sees nothing more in his work than the weighing and measuring of common grains of sand.

In the method evolved by the writer for graphically representing the characteristics of moulding sands and other detrital materials (first described in a paper read before the Iron and Steel Institute in 1923), the simple sedimentation of a definite weight or volume of sand in a test tube containing a fixed volume of water is used.

By shaking up the water and sand in the tube and observing the rate of sedimentation, *i.e.*, the time taken during the progressive climb of the sand level, the observed values can be plotted in a graph whose abscissæ represent time and ordinates depth of sediment.

The Method.

For general handiness and practicability, test tubes of 35 millimetres internal diameter and 230 millimetres long (9 in.) are employed. The sand to be examined is slowly dried and passed through a 30-mesh per linear inch sieve, fed into the test tube through a funnel, and gently shaken to a level of 3 in. above the bottom of the tube. Tap water, cooled to 15 C. after boiling, is poured into the tube, covering the sand to a depth of 6 in. (full tube) and then vigorously shaken by hand—a method found more effective than mechanical stirring or whirling, and yielding more regular results.

After shaking for one minute the sand is allowed to settle in the vertical tube for five minutes, when the water level will be found to have fallen by a definite amount, the new level remaining constant.

One inch of water subsidence is equivalent to about 36.5 per cent. of the original volume of the 3-in. depth of dry sand in the tube, and is a measure of the volume of the voids between the sand and silt grains. This is a useful index to the type and openness of the grain packing, and also, approximately, of the gas permeability of the sand.

The tube is next filled to the brim with water of 15 deg. C. and shaken as before, until, by a similar indication, mixture is effected. At the moment of complete mixture of the water and the sand the tube is held vertically, and the time taken for the rise of the sand in the tube noted, in seconds per each half inch of rise until the sand subsidence is complete. When plotted on a time base (seconds) a curve can be drawn through the points corresponding to the rise in the sand level at each interval of, say, 5 sec. (Curve O P Q in Fig. 1). The time of sand subsidence generally takes from 30 to 70 secs, during which time the tube is placed to rest vertically.

The liquid in the upper portion of the tube, above the sedimented sand and silt, is now in a state of agitation and clouded by the presence of very fine silt and clay. After a few minutes the liquid begins to clear the top of the tube, and a more or less definite horizon at the top of the cloudy clay water marks the division between the upper clear water and the lower clay plus silt water. This dividing level gradually falls and, if the extent of fall or subsidence is noted every

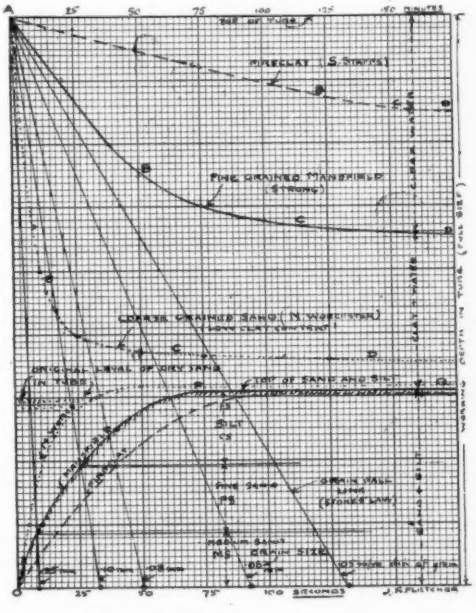

FIG. 1.—SUBSIDENCE GRAPHS FOR VARIOUS SANDS.

five minutes and plotted above a time base (minutes), the curve drawn through the points corresponding to the amount of fall and the time from commencement of the subsidence is characteristic of the amount of clay in the water column resting on the already sedimented sand and coarser silt grains in the bottom of the tube.

In Fig. 1 the upper curve A B C D, plotted in the manner described, has certain dominant characteristics. The first steep portion AB is an index to the fine silty clay present. In a sand with poor clay content but rich in very fine silt content (dust) the curve AB is steep. As the clay content increases the curve is less steep until, in the case of a fireclay the time taken to fall, say, 4 in. may exceed 24 hrs., whereas a normal moulding sand will be indicated by a fall of 4 in. in 30 or 40 mins.

In some sands the steep portion AB is succeeded by a slow curve BC, indicative of a certain percentage of still finer silt with the clay, and is representative of a definite type of moulding sand found in well-defined strata of sand deposits. Beyond the point C the curve CD becomes almost flat, and shows that clay alone is now being gradually deposited. By pouring off the clay water after, say, 3 hrs., weighing the water and clay before and after evaporating, the clay percentage in the originally weighed sample of sand poured into the test tube can be determined approximately.

It is usually found that the clay water will run off from the sand portion readily, leaving only a small percentage of clay behind. From check tests made by elutriation methods this percentage is found to bear a close relation to the void volume between the sand grains, as found by the first agitation test already described.

By means of oblique lines drawn across the subsidence graph corresponding to the time occupied by the grain descent from the top to the bottom of the tube (230 millimetres), each

oblique line corresponding to the fall of a grain of definite size (diameter) through still water, the approximate mechanical analysis of the various grades of sand and silt grains can be graphically determined.

The points in the lower sand subsidence curve OPQ cut by these oblique lines mark the position of the layer of grain size represented by the particular grain size.

The writer has found that, as the water through which the sand grains fall is of higher viscosity than pure water, and contains fine silt grains in opposite motion to the heavier sand grains, the lines which would otherwise correspond to Stokes's law have to be modified. He finds that this can be done readily by comparing the two subsidence curves (upper and lower) with elutriation grading analyses made on typical sands yielding the characteristic curves of subsidence.

Standardisation Difficulties.

It is admitted by the writer that his method of sand testing requires experience, and is not easy to standardise. It is, however, capable of affording, quickly, a clue to the character and amount of bonding material present in a moulding sand.

With the simple apparatus required any thoughtful sand enthusiast will find in the curves obtained from various sands differences which he can soon correlate with foundry experience.

By repeated sedimentation of the same sample he may measure the weakness or permanence of the bonding materials in the sand. He may find very readily whether a floor sand is worn out or not, and get an idea of the effect of milling various mixtures of virgin and spent sand. For effective research use the method is being used by the Cast Iron Research Association, alongside elutriation and mechanical tests of composition and physical bonding strength.

Dry sedimentation tests, using the velocity of fall and angle of repose of dried sands as a basis have been devised and used by the writer for obtaining rapid approximations of the silt and clay grade bulk percentages in moulding sands and other detrital and disintegrated materials. The hour glass type shown is one of the directions in which scientific toy-like apparatus can be made to yield very important results.

In bringing forward the types of easily used sand tests the writer is well aware that these can be meaningless unless the user is a patient seeker after truth, and can bring to bear the experience of the moulder and the caster.

The mould and the metal cannot be divorced, hence the foundry student must be able to visualise the effect of the molten metal on the sand and of the sand on the molten metal. The skin of a casting and that of its mould are mutually dependent. If either is destroyed or crippled by the other the result is generally disastrous.

There has been no time to touch the properties of heat conductivity, radiation, etc., possessed by the metal and the mould, nor of the surface changes in each during molten metal contact and afterwards. These are also of great importance to all students of metal founding, and cannot be ignored when digging more deeply into our subject.

After a long experience in the foundry itself as a mould maker and later as manager—in fact never away from it since youth—the writer finds a greater fascination than ever in a subject which has specially appealed to him for many years.

Many of our British foundrymen are enthusiastically devoted to their work, and amongst the rising ranks of metallurgists there are many who are keenly anxious to apply their increasing knowledge to actual works practice.

If, by calling attention to the relationship of the metal and its mould and to methods whereby the latter can be better fitted to play its proper part, a greater interest may be aroused in the minds of metallurgists and foundrymen—metal workers both—the time spent in discussing such a subject will be fruitful of good.

The Paper was illustrated by slides representing the various types of moulds described and by the testing apparatus and methods used by the author in the investigation of moulding sands.

I.B.F. Appoints New Secretary.

At a recent meeting of the Council of the Institute, Mr. Tom Makemson was appointed secretary in place of Mr. W. G. Hollinworth, who has, on account of his prolonged and serious ill-health, resigned his position. The best wishes of the foundry trade will go out to Mr. Hollinworth on his retirement after his six years of direction of their technical business. Mr. Makemson takes up his duties on December 1. Mr. Makemson is a native of Workington, Cumberland, and was educated at the Workington Higher Grade School, and for some time at a private school. He served apprentice as a patternmaker with Messrs. John Milburn, of Workington, and in 1911 became employed by the British Westinghouse Electric & Manufacturing Company, Limited, of Manchester (now the Metropolitan-Vickers Electric Company, Limited). A few years later he commenced the organisation of classes for apprentice patternmakers and moulders in the Westinghouse Company's Works School, and after conducting these classes for a few years he became associated with the Company's education depart-

MR. T. MAKEMSON,
(*Who has been elected Secretary of the I.B.F.*)

ment in a full-time capacity, and was responsible for organising and carrying out apprentice training in several departments of the works, particularly the foundries and pattern shop.

Some 2½ years ago Mr. Makemson was transferred by the Metropolitan-Vickers Company to their research department as a process engineer, with technical supervision of materials and shop processes, and he now holds this position.

Mr. Makemson commenced his technical training by taking evening classes in engineering at Workington, and continued these at the Manchester College of Technology. He then took the complete metallurgical course at the Manchester College of Technology, and received the Diploma of the Associateship of the College a few years ago.

Mr. Makemson joined the Institute of British Foundrymen in 1917, and in 1922 he was elected honorary secretary of the Lancashire Branch. He is an *ex-officio* member of the General Council, a member of the Finance Committee and Convenor of an informal Committee of all Branch Secretaries. He has devoted considerable attention to the question of training of foundry apprentices, and has presented several Papers on the subject before various bodies. He was intimately associated with the establishment of the Lancashire Branch Junior Section, of which he is now Vice-President.

"Useful Alloys of Aluminium and their Properties."

BY G. R. WEBSTER.

Aluminium in its pure state is not much used, owing to the elongation being too high and the tensile strength too low, but when alloyed with other metals it is increased in strength. Each of these alloys has its own particular property and use.

The useful alloys of aluminium seem to fall in three groups: (1) Aluminium with not more than 10 to 25 per cent. of added metals; (2) metals containing not more than 10 to 15 per cent. of aluminium; and (3) alloys of rare metals with aluminium containing from 0.5 to 5.0 per cent. of added metal.

The only elements now known to give solid solutions in aluminium are: Zinc, silicon, magnesium, copper, lithium and beryllium. No alloy of aluminium will be improved by heat-treatment and ageing unless it contains at least one substance which goes into solid solution in aluminium and shows decreasing solubility with falling temperature. The high shrinkage of aluminium has been reduced by alloying and need not exceed about 1.4 per cent.

Antimony alloys with aluminium in all proportions. Tensile and hardness strength are unaffected even up to 10 per cent. antimony, and may be hot rolled, although from 8 per cent. onwards partial lamination occurs. The addition of 1 per cent. antimony increases the ductility after which point it falls. The alloys have thus no special technical value.

Bismuth is harmful and only alloys in small proportions.

Beryllium, an alloy of 2 per cent. gave a tensile strength of 11.8 tons per sq. in., with an elongation of 10 per cent. on 2 in.; this alloy could be cold worked.

Chromium may be added up to 5 or 6 per cent., beyond which the casting temperature becomes excessively high. Shrinkage is reduced and the crystals become very coarse beyond 3 per cent. The alloys may be rolled at 500 deg. C. up to 4 per cent. chromium, and give greatly increased strength but low ductility. The hardness increases to 1 per cent. chromium and then falls.

Cadmium does not alloy with aluminium over 3 per cent.; its addition has no advantages whatever.

Cobalt has very nearly the same effect as nickel and has no special advantages over it.

Copper has little effect in reducing piping and shrinkage, but refines the grain. Alloys containing up to 12 per cent. may with care be rolled hot. The tensile strength rises rapidly up to 4 per cent. copper, then more gradually, the elongation pursuing an exactly opposite course. The best rolled product is obtained with 3 or 4 per cent. copper, the best casting with 10 to 15 per cent.

Cerium is particularly interesting, 0.5 per cent. exerting a considerable effect on the aluminium, raising the tensile strength of the metal from 4.5 tons per sq. in. to 10.3 tons per sq. in., and giving an elongation of 8.5 per cent. on 2 in. This alloy resists corrosion particularly well.

Iron has a great effect in reducing shrinkage, and appears to have a favourable influence on the resistance to weather. The strength increases slowly up to 4 per cent. iron and then slowly falls, whilst ductility falls rapidly. The alloys do not appear to have special advantages, but may be useful up to 4 per cent. iron.

Lead.—Only small quantities can be alloyed with aluminium. Has no bad effect; when present in 0.5 per cent. increases the ductility. Its addition presents no advantages.

Manganese at first increases shrinkage. The alloy may be hot rolled more or less successfully up to 5 per cent. manganese, the tensile strength increasing throughout and ductility falls. From 1 to 2 per cent. may be used in the rolled alloy, but without special advantages.

Molybdenum alloys readily, but requires a high casting temperature; the alloy with 0.5 to 1.0 per cent. may be used when hot rolled, but has no special advantages.

Magnesium in very small quantities makes the grain of aluminium finer; large quantities produce a coarse grain until 4 per cent. is reached, when it is again fine. Shrinkage is a minimum at 3 or 4 per cent. Between 3 and 10 per cent. the alloys tarnish rapidly. Plates may be rolled hot up to 6 or 7 per cent.; beyond this they are brittle. The tensile strength and elongation are very little affected up to 1.5 per cent.

Nickel increases the strength considerably, but the fracture becomes very coarse when the nickel percentage is high. The alloy may be hot rolled up to 11 or 12 per cent. nickel. The best material for rolling is that with 4 per cent., whilst 10 or 12 per cent. for casting on account of the low shrinkage. Nickel added by itself to aluminium produces unstable alloys.

Silicon in quantities up to 19 per cent. does not exert a very great influence on the corrodability of aluminium, although small quantities may do so. The strength and hardness increase regularly up to 12 per cent. silicon and then remains constant. The ductility falls slowly. The alloys may be rolled up to at least 20 per cent. silicon. As the specific gravity of such alloys is as low as that of aluminium, the addition of silicon is very advantageous, 5 to 7 per cent. being desirable for rolling and 10 to 12 per cent. for casting, and is used in the modified form after treatment by sodium or alkaline salts.

Tin has little effect in reducing shrinkage and entirely prevents hot rolling down to 200 deg. C. Cold rolling is successful up to 5 per cent. tin. The tensile strength is constant and then begins to increase slowly. The hardness is constant, whilst the ductility steadily falls.

Tungsten dissolves more readily in aluminium than chromium or manganese. The shrinkage is scarcely affected. The tensile strength and hardness of the hot rolled alloys increase a little at first, but become constant at 1.0 per cent., the ductility falling slowly.

Titanium gives alloys of very high melting point so that an alloy with 5 per cent. must be cast at 1,100 deg. C. Hot rolling is possible up to 6 per cent. The strength rises rapidly up to 1 per cent. and then slowly, the ductility falling in a similar manner .

Tantalum has little effect.

Vanadium alloys with difficulty. Alloys up to 4 per cent. roll quite well at 500 deg. C., the tensile strength and hardness increasing up to 2 per cent., when the ductility falls slowly.

Zirconium gives almost exactly the same result as titanium.

Zinc.—The alloys with zinc increase in tensile strength and hardness with increasing zinc up to 28 per cent. The ductility falls at first, rises to a maximum at 12 to 14 per cent., and then falls more rapidly. Alloys with 12 to 14 per cent. give the same elongation as pure aluminium, with about twice the tensile strength in the annealed state. In the remelting of aluminium-zinc alloys a decrease of aluminium and increase in zinc are to be expected. An allowance of 2 per cent. loss of aluminium should be made.

Copper is the most useful of all the alloying metals, magnesium coming next. Zinc gives the highest tensile strength, but the alloys corrode readily. Silicon and nickel stand next in usefulness.

In America preference is shown for aluminium-copper alloys over aluminium-zinc alloys, owing to ease of casting and relative freedom from "drawing." Sound alloys of the latter alloys are more easily produced by the addition of 1 to 2 per cent. copper.

Wills.

DIXON, W., of Bath Street, Glasgow, consulting engineer £20,931

GRANT-BURLS, SIR EDWIN, deputy-chairman of the Bengal Iron and Steel Company £33,828

ROGERS, J. F., of The Gardens, Monkseaton, Northumberland, retired foundry manager £7,805

MILNER, G., of Compton Road, Wolverhampton, retired iron and steel works manager £5,330

Piece Workers and Wage Deductions.

(BY A BARRISTER-AT-LAW.)

A Question Revived.

With the opening of the new Law Term the question of deductions from payments to piece-workers, recently discussed in an article in these columns, has again arisen. It is true that the matter this time had reference more particularly to the textile trades, but many of the points, and, indeed, the underlying principles, are of general application. Some brief remarks upon the broad question may be, therefore, opportune, so that the whole position may be correctly understood when the three judges of the Divisional Court proceed to give judgment, which at present is reserved in the case.

Facts of Latest Case.

The subject came before that Court upon a case stated by a Court of Summary Jurisdiction, and the piece-worker, the respondent, had preferred against her employers, the appellants, a claim under the Employers' and Workmen Act, 1875, for a certain sum as the balance of wages said to be due, which, it was alleged, had been unlawfully deducted by the employers. The latter, in turn, claimed damages stated to have been sustained by them through the respondent's negligence. It appeared that it was the respondent's duty to weave a good merchantable cloth without negligence and in a careful manner, that the respondent was to be paid for work done according to a standard list, an implied condition being that the prices in the list should apply to good merchantable cloth produced by the respondent's observance of the duty of a weaver. It seems that there was a practice to pay more than the standard price if the materials provided by the employers were defective, such being payment for extra work owing to defective material. But, apparently, if the workmanship proved to be bad or negligent, the custom obtaining for many years had been to pay a sum less than the sum in the standard list, this being the standard list price less compensation assessed by the employers of a reasonable amount for the loss incurred by them in the damage to their cloth. For the purposes of the case itself it was admitted that the respondent was negligent, and that the amount of the deduction made by the employers was fair and reasonable. The local justices decided that the standard list was the rate of wages applying, that the employers had illegally deducted the sum in question by way of fine from the respondent's wages, but that the employers' claim for damages should be allowed them.

The Jurisdiction of Local Justices.

It ought to be pointed out, by way of explanation, that the claim and counter-claim were in the nature of civil remedies, although the matter came before the local magistrates. The Act mentioned not only gives jurisdiction in these matters to the County Court, but also to Courts of Summary Jurisdiction. Such a Court may hear and determine a dispute under that Act, and such a Court shall, for the purposes of that Act, be deemed to be a Court of Civil Jurisdiction. In a proceeding in relation to such a dispute, that Court may order payment of any sum which it may find to be due as wages, or damages, or otherwise, and may exercise all or any of the powers conferred by that Act upon a County Court. But in relation to any such dispute the Summary Jurisdiction Court has no jurisdiction where the amount is above £10, can make no order for the payment of any sum above £10, exclusive of the costs incurred in the case, and is not to require security to any amount above £10 from any defendant, or his surety or sureties.

Power to Adjust and Set Off Claims.

The proceedings must be in relation to a dispute between an employer and workmen arising out of or incidental to their relation as such, and the Court—whether County Court or, where there is jurisdiction as stated, the Court of Summary Jurisdiction—may adjust and set off the one against the other, all such claims on the part either of the employer or of the workman arising out of or incidental to the relations between them, as the Court may find to be subsisting, whether such claims are liquidated or unliquidated, and are for wages, damages or otherwise.

Rescission of Contracts and Giving Security.

The Court may also rescind any contract between employer and workman upon such terms as it thinks just. Further, where the Court may otherwise award damages for any breach of contract, it may, if the defendant is willing to give security to the satisfaction of the Court for the performance by him of so much of his contract as remains unperformed, with the consent of the plaintiff, accept such security and order performance of the contract accordingly, in place either of the whole of the damages which would otherwise be awarded, or some part of such damages. The security will have the effect of binding the defendant and sureties for the performance of the contract, and in default for liability for payment of the sum specified. Any sum paid by such a surety for a defendant, with all costs incurred, shall be deemed to be a debt due to the surety by the defendant, and a Court of Summary Jurisdiction is given the requisite statutory power to order payment thereof.

Issues in the Latest Case.

The respondent contended that the Truck Act, 1831, applied to the case, and that the Truck Act, 1896, did not; but the employers, the appellants, argued that section 3 of the former Act had no relationship to a deduction for bad work, that the amount of wages earned by and the amount payable to a workman did not necessarily mean the same thing, because in this case the amount shown in the standard list was not earned: for some of the work was bad and the amount was subject to a deduction for bad work. It was also submitted that it was not payable because the amount to be paid was the net wage, after a deduction which formed no part of the wages.

Suggested Effect of Home Office Order.

It was also contended that the effect of the Order made by the Home Secretary on March 3, 1897, exempting the cotton-weaving industry from the operation of the Truck Act, 1896, left that industry free to make contracts permitting deductions for bad work.

Some Judicial Decisions.

In 1906 the Court of Appeal reversed a previous decision, and held that the Truck Act, 1831, did not allow an employer when paying wages to a workman to make any deductions except those expressly sanctioned by the Act, and that money, therefore, could not be deducted which a Court of Summary Jurisdiction had ordered a workman to pay to an employer in respect of breaches of contract to work. It may be added, however, that in 1910, in a case under section 3 of the Employers' and Workmen Act, 1875, previously set out, two of the Lords Justices, with a third Lord Justice dissenting, decided that the jurisdiction of a Court of Summary Jurisdiction extended to the adjustment of all subsisting claims between the parties, and that as a workman's claim for wages, although not put forward by the workman himself, had been brought to the knowledge of the Court by the employer, the Court had jurisdiction to set off that claim against the employer's claim for damages.

Important to Employers and Workmen.

In the present case it was submitted in the High Court that the employer's only remedy was to claim damages, and that the custom alleged for a sum to be assessed by the employer was illegal as being contrary to the Truck Acts, and that it was also unreasonable. It was argued for the respondent that there was no express contract except to pay standard list rates, and it was submitted that such an alleged custom for the employer to make deductions was clearly bad. On the other side, it was submitted that the Truck Acts recognised fines which were assessed by the employer without the consent of the workman, and that the contention could not be made that the custom of wage deductions was unreasonable merely on that ground.

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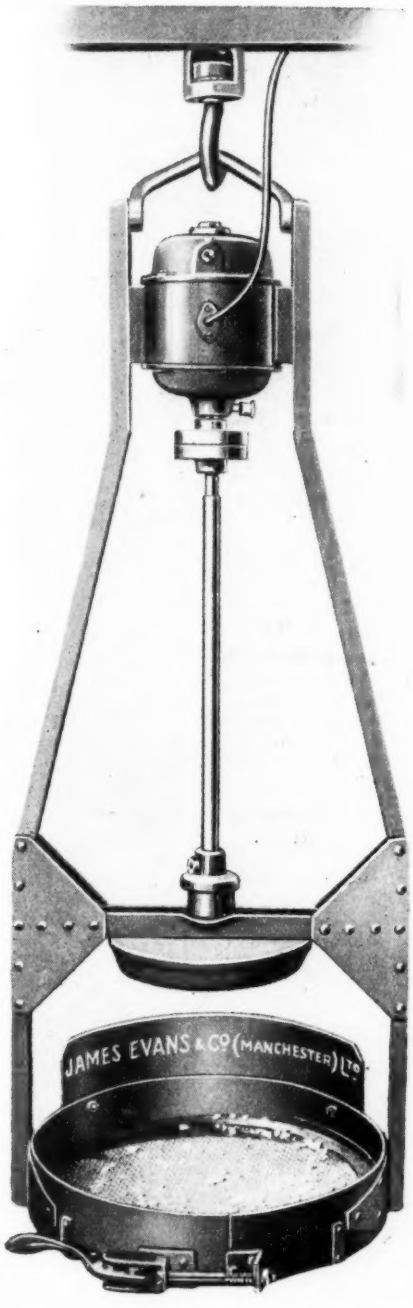

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The Metallurgist in Industry.

At the opening meeting of the London Section of the Institute of Metals, held in the Rooms of the Society of Motor Manufacturers and Traders, Limited, Pall Mall, S.W.1, the recently-elected Chairman, Mr. A. H. Mundey, gave an interesting address entitled, "The Metallurgist in Industry."

In his opening remarks the Chairman said that, in order to give some sort of a definition of the duties of a metallurgist in industry, he would attempt to paraphrase a sentence which described the avowed object of one of the greatest institutions of our Empire, and say that the work of the metallurgist is to adapt the metallurgical products of the earth to the service of man. He ventured to claim that this was the universal object of all branches of metallurgical science, and that when the research worker was investigating and studying the most abstruse problem in connection with the properties and behaviour of the metal, although he may be approaching his work in a purely philosophical attitude and without the slightest idea of the ultimate application of his researches to manufacture, there is always a fundamental desire to be of use and thus to be of service to industry.

He thought that it must be very unusual for any metallurgist not to have an underlying hope that his work may be of real economic value. He had known, however, very brilliant workers stoutly assert their entire want of interest in the economic application of their work: yet the actual value of it in the commercial sense was very great indeed.

Ignorant Foundrymen.

He recently had the privilege of hearing the address of Mr. R. J. Shaw, the President of the London Branch of the Institute of British Foundrymen. It was masterly in directness and courage. Its main theme was that foundrymen were ignorant of the scientific facts which were necessary for the improvement of their craft, that this ignorance is responsible for much of the want of progress and consequent anxiety and loss in the foundry industry.

It was surely a sign of grace when a representative man of great experience made this confession for his craft and also a sure indication that the members of the craft did not intend to remain ignorant of those scientific principles much longer.

What are our responsibilities in this connection? One of the first duties of the metallurgist who is engaged in industry is to interpret to his fellow-workers, who are craftsmen or in supervision, the results of the investigations which are reported in the proceedings of our own and other Institutions, or are made known to the scientific world through the usual channels.

In too many cases, owing to the nature of the reports and communications, the invaluable information contained is not made available to the management and operatives in our works; consequently industry suffers. It is increasingly important for any engineering establishment or other manufactory employing and working with metals on a fairly large scale to retain the services of a works metallurgist. It is satisfactory to note that all the great works engaged in the production of metals and alloys of every class are managed by metallurgists or engineers who have had long metallurgical training.

Scope of the Works Metallurgist.

The duties of the works metallurgist in a large engineering or manufacturing establishment are varied in the extreme. He must co-operate with the designers in selection of all materials and advise his directors in both technical and economic matters in relation to them. He is responsible for and frequently carries out the analysis of all the metals and many other materials employed and manufactured. He controls all furnace and pot charges, heat-treatment and pyrometric installations. Frequently he is in charge of the testing laboratories also, and takes the responsibility of the passing of all materials into the works and out of them as finished products for service. He has many other duties, including the educating of apprentices, etc., and in addition generally has a few pieces of industrial research on hand, either in the laboratory or more likely in the works.

These duties demand not only a well-trained man of liberal education, but one possessing real personality and character with broad sympathy and knowledge of human nature.

The Departments of State, the great industrial corporations and firms have almost universally shown their sympathy for and interest in research and its application to trade.

The foremen and workmen who have some real intelligent interest in and appreciation of the scientific principles of the job in hand produce better work and are altogether more desirable than those without that knowledge and interest. Also, to the operator himself work is much more of a job even though it be arduous and uncomfortable.

What sort of information does the workaday man need? He wants to know all he can about the light alloys, their best casting temperatures, heat treatment, forging and ageing; the working limits beyond which he may spoil his job, either as to temperature or duration of heating. He requires all the help he can get in his efforts to make sound castings, which will withstand hydraulic and air pressure tests, and hints as to heat-treatment of non-ferrous alloys generally, and especially castings of irregular and intricate shape. There is very little usable information available as to the conditions of alloys whilst in the fluid condition, such as contraction and expansion factors, surface tension, solubility of gases. All of these items as well as many others without doubt affect the foundryman in his efforts to produce sound homogeneous castings. The use of permanent moulds as in die-casting, whether it be pressure or gravity die-casting, increases the need for more specialised information of the alloys in the fluid state than ever before, for the difficulty of completely filling the moulds, of eliminating gases, relieving contraction stresses, and avoiding weak areas due to objectionable crystal growth, and such problems are now increased tenfold.

It is abundantly proved in the case of many important alloys that satisfactory castings are not produced from a first melting. This subject is one of unfailing interest to thoughtful and well-trained workers, for it must be perfectly clear that no one engaged in the commercial production of castings is anxious to increase the number of melting operations, with all their attendant expenses in fuel, wages, overhead charges, and also melting losses.

Abuse of Specifications.

The British Engineering Standards Association has done an immense amount of good work in regularising specifications, and the Public Departments, such as the Admiralty, War Office, Air Board, and also the railway and shipping companies, have brought their requirements into line to a very great extent. But there is still a tendency to quote a specification which is not in every respect appropriate to the particular detail under consideration. The designer is perhaps too busy or does not see the necessity to consult the metallurgist as to whether the tests can be obtained from the casting or other detail, on account of its form or treatment, and the inspector quite correctly rejects the job.

Still worse is the case where the designer puts no specification upon his drawing and it is left to a buyer or stores officer, who, however capable in his work, is not to be expected to have the specialised information at his disposal right away which is necessary to make the requisitioned article.

The effect of impurities on the metals is also an everlasting subject of interest and importance. It is admitted that the literature is rich on this subject, the reports of researches very numerous, but we need more and more. The works metallurgist, the works manager, and his staff working with varying alloys of the non-ferrous metals, encounter fresh problems daily. Here one is apt to envy for a brief space the steel worker, who knows his arch enemy, phosphorus, and can think in fairly accurate terms of the limits he must set and of the effects of the foreign substance. The same conditions apply with regard to the other elements which affect the properties of the principal metal, iron, whether in a beneficent or an undesirable fashion.

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J. GRAYSON LOWOOD & Co., Ltd.

DEEPCAR, nr. SHEFFIELD.

Telegrams: "LOWOOD, DEEPCAR."

Trade Talk.

THE MEMBERS of the Incorporated Sales Managers' Association held a dinner yesterday at the Princes' Restaurant, when an address on "Inter-Empire Salesmanship" was delivered by Sir Harry Brittain, M.P.

ONLY TWO VESSELS were launched on the Tyne during September, the tonnage being 8,178, as compared with 36,685, representing six vessels launched in September, 1925. This year's total up to date is 21 vessels—109,748 tons gross—a decrease of 21 vessels and 52,640 tons.

THE ADMIRALTY CONTRACT for the floating dock in connection with the Singapore naval base is to be given to Swan, Hunter & Wigham Richardson, Limited, of Wallsend, in conjunction with Sir W. G. Armstrong, Whitworth & Company, Limited. The total amount of the contract is said to be £1,200,000.

MR. R. S. DALGLIESH, a Tyneside shipowner, and Sheriff-elect of Newcastle, has concluded the purchase from the liquidators of the concern of Blair & Company, Limited, marine engineers, Stockton. A new company will be formed with Mr. Dalgliesh as chairman. The works have been closed down for about 15 months.

THE CAMBRIAN WAGON COMPANY, LIMITED, have just completed the construction of a 12 tons capacity vacuum fitted, covered goods van. It is one of a large order which is being executed by the company for the Great Western Railway Company for main line traffic, and is the first of its type to be built in South Wales.

ESTABLISHED AT LEAST A CENTURY AGO, the Bromley Ironworks, Brierley Hill (which up to three years ago were operated by Roberts & Cooper, Limited, for nearly 40 years), have been acquired by John Cashmore, of Great Bridge, for the purpose of demolition. The works formerly found employment for 200 men and are within a few hundred yards of the site of the Leys Ironworks, which were demolished about two years ago.

THE MEMBERS OF THE SOCIETY OF ENGINEERS met last Monday, November 1, when a paper was read entitled "Some Products of a Small Machine Shop," by Miss A. Ashberry, managing director and works manager of Atalanta, Limited. It is interesting to note that this is the first occasion on which a paper has been read before the society by a lady, and the author is the first lady member.

COMPENSATION FOR AN ACCIDENT alleged to have been sustained in his employment at a foundry was claimed at Exeter County Court by William Ernest Andrews, aged 17, a machine moulder, the respondents being Messrs. Willey & Company, Limited, Exeter. The claim was for compensation at the rate of 10s. 11d. per week from April 16 to May 19, claimant alleging that he strained his back in lifting the upper part of a mould weighing 28 or 29 lbs. Respondents denied that there had been any accident, and His Honour Judge Higgins dismissed the claim.

AT A MEETING of the Mansfield Engineering Company, Limited, held yesterday, the following resolution was proposed:—That the capital of the company be reduced from £100,000 divided into 100,000 shares of £1 each to £62,500 divided into 100,000 shares of 12s. 6d. each, and that such reduction be effected (*a*) by cancelling capital which has been lost or is unrepresented by available assets to the extent of 2s. 6d. per share upon each of the 87,225 shares which have been issued and are now outstanding; (*b*) by returning to the holders of the said 87,225 shares which have been issued paid-up capital to the extent of 5s. per share; and (*c*) by reducing the nominal amount of not only the said 87,225 shares which have been issued, but also the 12,775 unissued shares, from £1 to 12s. 6d. per share.

A CONTRACT FOR NO FEWER than eight hundred low-sided bogie wagons required by the Central Argentine Railway has, states "Modern Transport," been awarded to the Midland Railway Carriage and Wagon Company, Limited, of Washwood Heath, Birmingham. Clayton Wagons, Limited, of Lincoln, are to build six bogie saloons, to the order of the Crown Agents for the Colonies, for use on the Palestine Railways, and two bogie sleeping coaches for the Buenos Aires Midland Railway. Contracts for twelve high-sided bogie wagons and nine bogie platform wagons for the North Western (India) State Railways have been placed with Stableford & Company, Limited, of Coalville, Leicestershire, and the Gloster Railway Carriage and Wagon Company, Limited, respectively. In addition to the contracts for open goods wagons, tank wagons and brake vans, placed with the Blake Boiler, Wagon and Engineering Company, Limited, of Darlington, the Sudan Government Railways have awarded an order for 120 bogie covered goods wagons to the Metropolitan Carriage, Wagon and Finance Company, Limited, of Saltley, Birmingham.

Contracts Open.

Bradford, November 13.—(6) Phosphor-bronze, gunmetal and brass castings from January 1, 1927, for the Tramways Committee. Mr. R. H. Wilkinson, general manager, 7, Hall Ings, Bradford.

Bradford, November 13.—(1) Bolts, nuts, screws, washers, nails and miscellaneous ironmongery; (2) files, twist drills and hacksaw blades; (5) iron, malleable iron and steel castings; (7) insulated bolts and strains and controller contacts; (8) iron and steel bars, angles, channels and sheets; (15) steel pinions, from January 1, 1927, for the Tramways Committee. Mr. R. H. Wilkinson, general manager, 7, Hall Ings, Bradford.

Cheadle, November 9.—12-in. iron pipes, bends, sluice valves, etc., to syphon under railway, for the Cheadle and Gatley Urban District Council. Mr. G P. Stanley, acting engineer and surveyor, Council Offices, Cheadle.

Dublin, November 8.—Brass goods for 12 months ending December, 1927, for the Dublin United Tramways Company (1896), Limited. The Company's Offices, 59, Upper Sackville Street, Dublin. (Fee 2s. 6d.)

Dublin, December 1.—One 4-ton level luffing electric portal crane, for the Dublin Port and Docks Board. Mr. J. Mallagh, the engineer of the Board, East Wall, Dublin.

Southampton, November 11. — Heavy cast-iron double-socket sluice valves, 2-in. to 12-in. diameter, for the Town Council. The Waterworks Engineer's Office, 21, Shirley Road, Southampton.

Southampton, November 11.—1,000 3-in. diameter, 100 5-in., 80 10-in., 12 18-in., 12 24-in., 20 2-in. cast-iron and spigot and socket pipes; also 13 tons of spigot and socket special castings, for the Corporation. The Waterworks Engineer's Office, 21, Shirley Road, Southampton.

Whitstable, November 15.—5,900 yards of 12-in. internal diameter water main of cast iron and, alternately, steel tubes, for the Urban District Council. Mr. J. Dunn, surveyor and water engineer, Council Offices, Whitstable. (Fee £2 2s., returnable.)

Personal.

MR. J. FERDINAND KAYSER has joined Messrs. James Neill & Company (Sheffield), Limited, Composite Steel Works, Napier Street, Sheffield, where he will concentrate on the development of permanent magnet manufacture, in which subject he is a recognised specialist.

JUDGE ELBERT H. GARY, chairman of the United States Steel Corporation, celebrated his eightieth birthday on Friday, October 8. Among congratulatory testimonials received by Judge Gary were illuminated engrossed resolutions received from the directors of the American Iron and Steel Institute, from a group of associations of German iron masters, and from the directors of the United States Steel Corporation.

THE KELVIN GOLD MEDAL was presented to Sir Charles Parsons on Tuesday in the great hall of the Institution of Civil Engineers. The presentation to Sir Charles Parsons was made by Sir William Ellis, president of the Institution, who was in the chair. He described Sir Charles Parsons as a great scientist and a man who, by his industry and application, had turned his scientific ability to the practical benefit of this country and the whole world. Sir Charles Parsons expressed his appreciation of the gift. Following the presentation, the 32nd James Forrest Lecture was delivered by Senatore Marconi, the subject being "Radio Communications."

THE ANNUAL MEETING of the Central Board of the Shipbuilding Employers' Federation was held in Edinburgh last week, when, on the motion of Mr. J. T. Batey, senior vice-president, Mr. John Barr, of Barrow, was re-elected president for the ensuing year. In addition to Mr. J. T. Batey, of R. and W. Hawthorn, Leslie & Company, Limited, Hebburn, Mr. A. J. Campbell, of William Beardmore & Company, Limited, Dalmuir, and Sir Andrew R. Duncan, Mr. J. H. Edwards, of the Middle Docks and Engineering Company, Limited, South Shields, was also elected a vice-president. Mr. Edwards is chairman of the North-East Coast Shiprepairing Association, and has been closely identified with the work of the Federation for several years as a member of the Central Board and the Executive Committee. Mr. A. L. Ayre, of the Burntisland Shipbuilding Company, Limited, Burntisland, was appointed chairman of the Conference and Works Board of the Federation, with Mr. W. A. Henderson, of D. and W. Henderson & Company, Limited, Glasgow, as vice-chairman.

"SERVICE GRC FIRST"

WHEN YOU ARE TIRED

OF

SAND THAT BURNS ON;

CUPOLA LININGS THAT FALL AWAY;

LADLE LININGS THAT NEED RENEWAL EVERY TEN HEATS OR SO;

SILICA BRICKS THAT SPALL, AND FIRE-BRICKS THAT MELT,

WRITE TO US

We can give you refractory cements that last longer than the bricks, sands that shrink away from the metal as it cools, special bricks to resist acid, basic and all kinds of corrosive slags, and a cupola lining that will save you

TIME, TROUBLE & WORRY

Write us and we will come and see you!

The GENERAL REFRACTORIES Co. Ltd., Sheffield

BCM/OK9
LONDON.

No need to try and remember our name in case it is unfamiliar to you. This is our British Monomark. Envelopes addressed simply thus will be delivered to us by arrangement with the G.P.O.

THE FOUNDRY TRADES EQUIPMENT & SUPPLIES ASSOCIATION LTD.

IRON AND STEEL MARKETS.

Pig-Iron.

MIDDLESBROUGH.—Although still remaining practically idle, as far as it concerns current business, the tone of the Cleveland iron market during the past week regained a more hopeful tendency as regards the future outlook, and a few transactions have been reported on prompt account, a number of parcels changing hands for delivery this month. Pig-iron stocks are, of course, a thing of the past, and there seems no likelihood of the accumulation of any descriptions for a considerable period ahead, as the restarting of the furnaces cannot possibly be general until some few weeks after the pits have re-opened. Prices of Cleveland iron now stand as follow:—No. 1, 125s.; No. 3, G.M.B., 120s.; No. 4 foundry, 119s.; and No. 4 forge, 118s. 6d. per ton. With the end of the coal strike drawing near, buyers are not now willing to commit themselves to any extent, and producers are by no means keen to quote in view of the uncertainty as to fuel prices.

The Tees-side hematite market has practically come to a standstill, mixed numbers, and in fact all the ordinary grades, being unobtainable. A few lots of off-grade material are to be had at round about 92s. 6d. per ton for East Coast mixed numbers. On the North-West Coast Bessemer mixed numbers are now quoted at £4 16s. per ton, delivered at Glasgow; £4 19s. 10d. per ton, delivered at Sheffield; and £5 7s. 6d. to £5 15s. per ton, delivered at Birmingham.

LANCASHIRE.—The general attitude of sellers of foundry pig in the local markets is now to decline forward dealings, and only a few prompt parcels are on offer, a consignment of Middlesbrough No. 3 for immediate delivery having changed hands at 137s. 6d. per ton, delivered Manchester, and prices are moving steadily upward. Some Scottish iron, an approach to No. 3, has reached 127s. 6d. per ton, although this is below the figure that is being quoted generally for No. 3 iron, this being about 135s. per ton.

THE MIDLANDS.—No improvement can be reported in the position of the local markets for foundry iron, there having been no change in current quotations for Cleveland No. 3, which stands at about 75s. 6d. per ton delivered, with No. 4 Scotch quality at 125s. per ton.

SCOTLAND.—Demand for pig-iron of late has been on a rather slower scale, but the price of any iron available is higher, and as much as 115s. at furnaces has been paid for No. 3 Scotch foundry. There are odd parcels in second-hands, but, generally speaking, the makers are now sold out of ordinary No. 3, and where iron is available it is in lower qualities and in very limited quantities.

Steel.

Difficulties in obtaining adequate fuel supplies continue to retard expansion of production in this section of the industry, and at Sheffield last week there were no dealings in local acid or basic billets. The rolling mills have advanced their charges by 25s. per ton on pre-dispute figures. Slightly more crucible steel is being produced, although high fuel costs are hampering this branch very badly. On the whole, however, trade keeps fairly brisk, in spite of the enormous handicap under which it is labouring, and many firms' order books present a very healthy appearance. In the tinplate market stock plates have been selling on a basis of 23s. to 23s. 6d. for cokes, net cash, f.o.b. Welsh ports.

Scrap.

Due to the prevailing scarcity of the staple material for foundry purposes, there is now a slightly more active demand for cast-iron scrap as a substitute, while other metals are in much less request. In Scotland last week business was done in heavy cast iron machinery scrap in pieces adapted for foundry purposes at 80s. to 82s. 6d. per ton, with heavy ordinary cast iron quality at 5s. per ton less. Old cast iron railway chairs are also in demand, and make 80s. to 81s. 6d., while light cast iron scrap is on offer at 60s. per ton, all for delivery f.o.t. consumer's works.

Metals.

Copper.—Prevailed upon doubtlessly by the stabilising influence on values, the market for standard copper last week reflected a more buoyant tendency than has been in evidence of late, and values have been maintained at steady levels. It is significant that quite heavy withdrawals of rough bar material have been already made from English warehouses within the last two months prior to the control scheme coming into force, and the stocks are expected to be further considerably reduced over the end of this year, partly for conversion into refined copper.

Official closing prices of standard copper have been as follow:—

Cash: Thursday, £58 5s. to £53 7s. 6d.; Friday, £57 15s. to £57 17s. 6d.; Monday, £57 12s. 6d. to £57 15s.; Tuesday, £57 15s. to £57 17s. 6d.; Wednesday, £57 16s. 3d. to £57 18s. 9d.

Three Months: Thursday, £59 2s. 6d. to £59 5s.; Friday, £58 12s. 6d. to £58 15s.; Monday, £58 10s. to £58 12s. 6d.; Tuesday, £58 12s. 6d. to £58 15s.; Wednesday, £58 15s. to £58 17s. 6d.

Tin.—Though slightly receding from the highest figures of the recent boom period, standard values of this metal evidence no inherent weakness, and with the issue of the October statistics it is fully expected will regain, if not surpass, their previous high levels. Last week the volume of business was at first heavy, but later contracted when the market showed more strength, although the American purchases remained light. The premium on cash and near tin is now only about £4 10s., as against £13 10s. at mid-October.

Official closing prices of standard tin have been as under:—

Cash: Thursday, £303 15s. to £304 5s.; Friday, £295 10s. to £296; Monday, £293 10s. to £294; Tuesday, £297 5s. to £297 10s.; Wednesday, £300 to £305 5s.

Three Months: Thursday, £300 to £300 5s.; Friday, £293 15s. to £294; Monday, £290 15s. to £291 5s.; Tuesday, £293 15s. to £294; Wednesday, £294 5s. to £294 10s.

Spelter.—Values of ordinary spelter of late have been subject to slight fluctuations, but on the whole the market may be pronounced as fairly steady. Offers from Continental smelters have been made a little more freely, but have been well absorbed, and consumers are more inclined to cover their needs.

The following are the week's prices:—

Ordinary: Thursday, £34 2s. 6d.; Friday, £34 1s. 3d.; Monday, £33 12s. 6d.; Tuesday, £33 8s. 9d.; Wednesday, £33 10s.

Lead.—Business in foreign pig for prompt delivery has of late developed a rather weaker tendency, but at last week's close was reported a shade firmer. Landings notified amounted to 25,484 tons, making 199,661 tons for the nine months, much the same as last year. The surplus under present circumstances has become unwieldy. Supplies have increased from North America, where the price has been cut to about 8.30 cents per lb.

The week's prices are appended:—

Soft foreign (prompt): Thursday, £30 13s. 9d.; Friday, £30 6s. 3d.; Monday, £29 12s. 6d.; Tuesday, £29 10s.; Wednesday, £29 15s.

Catalogues Received.

Cast Iron Pipes.—The November Monthly Stock List issued by the Staveley Coal & Iron Company, Limited, Chesterfield, is now available.

Chain Drives.—One can always rely on the publicity matter emanating from the house of Messrs. Hans Renold, Limited, Burnage Works, Didsbury, Manchester, to give a good deal of practical information. This is especially true of their latest pamphlet (No. 00045), bearing the title, "Standard Chain Drives." As transport is of paramount interest to the foundry industry, real knowledge of this system of drives is of advantage.

Air Compressors.—Messrs. J. & G. Weir have sent us an advance copy of a new catalogue dealing with air compressors. Whilst most of the models shown are of high pressure, and designed for marine use, we do not doubt that types are available for use with moulding machines, pneumatic tools, and the numerous other applications to which compressed air is put in the modern foundry. The catalogue has sixteen art pages, and maintains the very high level which one associates with the publicity matter emanating from this firm.

Sterling

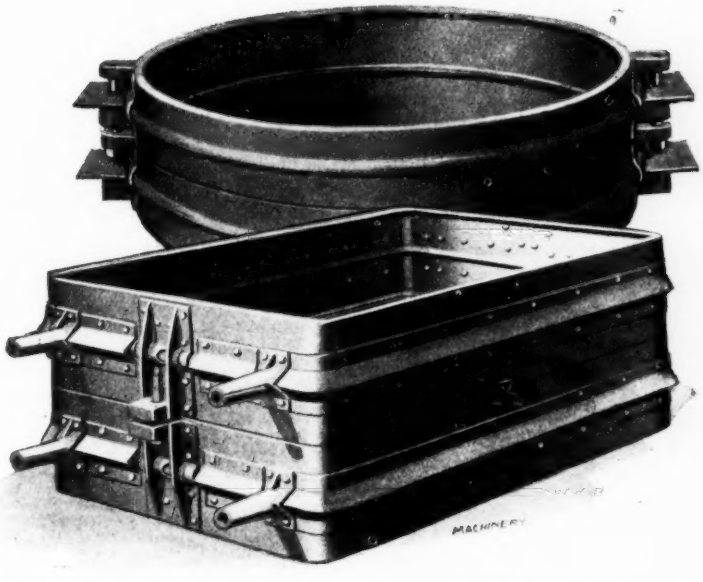
"THE ONLY BOX WORTH GIVING A SECOND THOUGHT"

These were the words of an experienced Foundryman when asked to express his opinion of STERLING MOULDING BOXES.

They sum up the feelings of every STERLING user: Yes, the only Box worth giving a second thought.

You are losing more than you probably realise from your old-fashioned box equipment. Every unnecessary pound your Moulders have to lift represents money lost; every cross-jointed mould—honest effort thrown to the winds.

WHEREVER CASTINGS ARE MADE
STERLING BOXES WILL
HELP TO MAKE THEM
BETTER and CHEAPER



STERLING FOUNDRY SPECIALTIES LTD.
BEDFORD

London Office: 13, VICTORIA STREET, S.W.1.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash ..	57	16	3
Three months ..	58	15	0
Electrolytic	66	10	0
Tough	64	0	0
Best selected ..	64	10	0
Sheets	92	0	0
India	73	10	0
Wire bars	67	0	0
Do. November ..	66	17	6
Do. December ..	66	17	6
Ingot bars	66	17	6
H.C. wire rods ..	70	12	6
Off. av. cash, Oct.	58	7	3⅝
Do., 3 mths. Oct.	59	3	10⅝
Do., Sttlmnt, Oct.	58	7	3½
Do., Electro, Oct.	66	10	10
Do., B.S., Oct. ..	65	4	8⅝
Aver. spot price copper, Oct. ..	58	7	3
Do.,wire bars, Oct.	66	15	8½

Solid drawn tubes 13d.
Brazed tubes .. 13d.
Wire .. .. .. 9¼d.

BRASS.

Solid drawn tubes .. 12d.
Brazed tubes .. .. 13½d.
Rods, drawn .. .. 11½d.
Rods, extd. or rlld. .. 7½d.
Sheets to 10 w.g .. 10⅝d.
Wire .. .. .. 10½d.
Rolled metal .. .. 10½d.
Yellow metal rods .. 7½d.
Do. 4 × 4 Squares 8d.
Do. 4 × 3 Sheets .. 8½d.

TIN.

Standard cash ..	300	0	0
Three months ..	294	5	0
English	298	0	0
Bars	297	10	0
Straits	304	15	0
Australian		—	
Eastern	299	5	0
Banca		—	
Off. avr. cash, Oct.	312	14	6⅜
Do., 3 mths., Oct.	303	14	3⅜
Do., Sttlmt. Oct.	312	13	9⅜
Aver. spot., Oct.	312	14	6¼

SPELTER.

Ordinary	33	10	0
Remelted	32	5	0
Hard	27	0	0
Electro 99.9 ..	36	0	0
English	34	2	6
India	30	0	0
Zinc dust	43	0	0
Zinc ashes	16	0	0
Off. aver., Oct. ..	34	4	0⅜
Aver., spot, Oct.	34	5	1½

LEAD.

Soft foreign ppt.	29	15	0
English	31	0	0
Off. average, Oct.	30	15	2½
Average spot, Oct.	30	16	5

ZINC SHEETS, &c.

Zinc sheets, English	42	10	0
Do. V.M. ex whf.	39	10	0
Rods	45	0	0
Boiler plates ..	39	0	0
Battery plates ..	38	10	0

ANTIMONY.

Special brands, Eng.	74	10	0
Chinese	58	0	0
Crude	39	0	0

QUICKSILVER.

Quicksilver .. 16 17 6

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon —
25% 9 2 6
45/50% 10 10 0
75%.. .. .. 15 17 6
Ferro-vanadium—
35/40% 14/- to 14/6 lb: va.
Ferro-molybdenum—
70/75% c. free .. 5/3 lb.
Ferro-titanium—
23/25 % carbonless 1 1½d.
Ferro-phosphorus, 20/25%, £17 0 0
Ferro-tungsten—
80/85%,c.fr. .. 1/5 lb.
Tungsten metal powder—
98/99% 1/9 to 1/10 lb.
Ferro-chrome—
2/4% car. .. £33 0 0
4/6% car. .. £23 0 0
6/8% car. .. £21 15 0
8/10% car. .. £20 15 0
Ferro-chrome—
Max. 2% car. £37 0 0
Max. 1% car. £43 5 0
Max.0.70%car. £54 0 0
70%,carbonless 1/5 lb.
Nickel—99%, cubes or pellets .. £170
Cobalt metal—98/99% 10/- lb.
Aluminium 98/99% £107 to £112
Metallic Chromium—
96/98% .. 3/- lb.
Ferro-manganese (net)—
76/80%, loose £15 0 0
76/80%, packed £16 0 0
76/80%, export £15 0 0
Metallic manganese—
94/96%, carbonless 2/- lb.
Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten .. s. d. 2 6
Finished bars, 18% tungsten .. 3 0
Per lb. net, d/d buyers' works.
Extras—
Rounds and squares 3 in. and over .. 4d.lb.
Rounds and squares under ½ in. to ¼ in. 3d. lb.
Do. under ¼in. to ⅛ in. .. .. 1/- lb.
Flats, ½in. × ¼in. to under 1 in. × ⅛ in. 3d. lb.
Do. under ½in. × ¼in. 1/- lb
Bevels of approved sizes and sections 6d. lb.
Bars cut to length 10% extra
Scrap from high-speed tool steel—
Scrap pieces .. .. 3d.
Turnings and swarf 1d.
Per lb. net, d/d steel makers' works.

SCRAP.

South Wales—£ s. d. £ s. d.
Hvy. steel 2 12 6 to 2 17 6
Bundled steel & shrngs. 2 5 0 to 2 7 6
Mixed iron & steel 2 7 6 to 2 12 6
Heavy cast iron 2 15 0 to 2 17 6
Good machinery for foundries 2 17 6 to 3 5 0
Cleveland—
Heavy steel .. 3 0 0
Steel turnings .. 1 15 0
Cast iron borings 1 10 0
Heavy forge .. 4 2 6
Bushelled scrap 3 10 0
Cast-iron scrap 3 8 6 to 3 11 0
Lancashire—
Cast-iron scrap 3 7 6
Hvy. wrought .. 3 2 6
Steel turnings .. 1 17 6
London — Merchants' buying prices delivered yard.
Copper (clean).. 49 0 0
Brass (clean) .. 38 0 0
Lead (less usual draft) 27 10 0
Tea lead .. 23 10 0
Zinc 23 10 0
New aluminium cuttings .. 84 0 0
Braziery copper 45 0 0
Gunmetal .. 47 0 0
Hollow pewter 200 0 0
Shaped black pewter .. 150 0 0

PIG-IRON.

(*f.o.t. unless otherwise stated*).

N.E. Coast—
Foundry No. 1 .. 125/-
Foundry No. 3 .. 120/-
Foundry No. 4 .. 119/-
Forge No. 4 .. .. 118/6
Hematite No. 1 .. 93/-
Hematite M/Nos. .. 92/6

N.W. Coast—
Hem. M/Nos. d/d Glas. 96/
„ d/d Birm. 107/6 to 115/-

Midlands—
Staffs. common* .. —
„ No. 4 forge .. —
„ No. 3 foundry —
Shrops. basic .. .. —
„ Cold blast, ord.* —
„ „ roll iron* .. —
* d/d Birmingham.
Northants forge .. .. —
„ fdry No. 3 .. —
Derbyshire forge .. —
„ fdry. No. 3 .. —
„ basic .. .. .. —

Scotland—
Foundry No. 1 .. —
„ No. 3 .. 115/-
Hem. M/Nos. .. —

Sheffield (d/d district)—
Derby forge .. .. —
„ fdry. No. 3 .. —
Lincs. forge .. .. —
„ fdry. No. 3 .. —
E.C. hematite .. .. —
W.C. hematite .. 99/10

Lincs. (at furnaces)—
Forge No. 4 .. .. —
Foundry No. 3.. .. —
Basic .. .. .. —

Lancashire (d/d eq. Man.)—
Derby forge .. .. —
„ fdry. No. 3 .. —
Northants foundry No. 3 .. .. .. —
Dalzell, No. 3 .. .. 135/-
Summerlee, No. 3 .. 135/-
Glengarnock, No. 3 .. 135/-
Gartsherrie, No. 3 .. 135/-
Monkland No. 3 .. .. 135/-
Coltness, No. 3 .. .. 135/-
Shotts, No. 3 .. .. 135/-

FINISHED IRON & STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars (cr.) nom. ..	12	0	0 to 13	10	0	
Angles			12	0	0	
Tees to 3 united ins.			12	10	0	
Nut and bolt iron			—			
Hoops			14	10	0	
Marked bars (Staffs.) f.o.t. ..			14	0	0	
Gas strip			12	10	0	
Bolts and nuts .. ¾ in. × 4 in.			15	5	0	
Steel—						
Ship plates			8	12	6	
Boiler plts. ..			11	5	0	
Chequer plts. ..			9	15	0	
Angles			7	12	6	
Tees			8	12	6	
Joists			7	12	6	
Rounds and Squares 3 in. to 5½ ins. ..			—			
Rounds under 3 in. to ⅜ in.(Untested)			9	0	0	
Flats, over 5 in. wide and up ..			—			
Flats, 5in. to 1½in.			—			
Rails, heavy ..			8	10	0	
Fishplates			12	10	0	
Hoops (Staffs.) ..			10	10	0	
Black sheets, 24g.			12	2	6	
Galv. cor. sheets, 24g.			17	5	0	
Galv. fencing wire 8g. plain			12	10	0	
Billets, soft ..			7	15	0	
Billets, hard ..			8	2	6	
Sheet bars			7	10	0	
Tin bars d/d.. ..			7	10	0	

PHOSPHOR BRONZE.

	Per lb.	basis.
Strip	1	3
Sheet to 10 w.g. ..	1	3½
Wire	1	4
Rods	1	3
Tubes	1	8
Castings	1	2

Delivery 3 cwt. free
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

Per lb.
Ingots for raising 9d. to 1/3
Rolled—
To 9 in. wide 1/3 to 1/9
To 12 in. wide 1/3½ to 1/9½
To 15 in. wide 1/3½ to 1/9½
To 18 in. wide 1/4 to 1/10
To 21 in. wide 1/4½ to 1/10½
To 25 in. wide 1/5 to 1/11
Ingots for spoons and forks .. 9d. to 1/5½
Ingots rolled to spoon size .. 1/- to 1/8½
Wire round—
3/0 to 10 G. 1/6½ to 2/1½
with extras according to gauge.

AMERICAN IRON & STEEL.

At Pittsburgh unless otherwise stated.	Dols.
No. 2X foundry, Phila.	21.76
No. 2 foundry, Valley	20.26
No. 2 foundry, Birm.	20.00
Basic	19.76
Bessemer	20.76
Malleable	20.26
Grey forge	19.76
Ferro-mang. 80% d/d	88.00
Bess. rails, h'y, at mill	43.00
O.-h. rails, h'y at mill	43.00
Bess billets	35.00
O.-h. billets	35.00
O.-h. sheet bars ..	36.00
Wire rods	45.00
	Cents.
Iron bars, Phila. ..	2.22
Steel bars	2.00
Tank plates	1.90
Beams, etc.	2.00
Skelp, grooved steel ..	1.90
Skelp, sheared steel ..	1.90
Steel hoops	2.50
Sheets, black, No. 24..	3.00
Sheets, galv., No. 24 ..	3.85
Sheets, blue an'l'd, 9 & 10	2.30
Wire nails	2.65
Plain wire	2.50
Barbed wire, galv. ..	3.35
Tinplate, 100 lb. box	$5.50

COKE (at ovens).

Welsh foundry .. .. —
„ furnace .. .. —
Durham & North.
„ foundry .. .. —
„ furnace 60/-
Other Districts, foundry .. .. —
„ „ furnace (basis) —

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes, 20×14, box		23/-
„	28×20, „	46/-
„	20×10, „	—
„	18¾×14, „	—
C.W.	20×14, „	—
„	28×20, „	—
„	20×10, „	—
„	18¾×14, „	—

Terneplates 28×20, — per box basis f.o.b.

SWEDISH IRON.

Bars,hammered £18/10 to £19/0
Rolled Ord. £15/10/0 to £16
Nail rods £16 5 0 to £16 15 0
Keg. steel nom. £33 to £35
Faggot steel nom. £22 to £25
Blooms, according to quality £9 to £12
Pig-iron £6 0 0 to £6 10 0 all f.o.b. Gothenburg.

TUBES AND FITTINGS.
Up to and incl. 6 in.

	Tubes	*Fittings*
Gas ..	60%	.. 50%
Water ..	55%	.. 45%
Steam ..	50%	.. 40%

W.I. 10% extra.

DAILY FLUCTUATIONS.

Standard Copper (Cash).

	£	s.	d.		
Oct. 28	58	5	0	dec.	5/-
,, 29	57	15	0	,,	10/-
Nov. 1	58	12	6	,,	2/6
,, 2	57	15	0	inc.	2/6
,, 3	57	16	3	,,	1/3

Electrolytic Copper.

	£	s.	d.		
Oct. 28	66	10	0	No change	
,, 29	66	10	0	,,	,,
Nov. 1	66	10	0	,,	,,
,, 2	66	10	0	,,	,,
,, 3	66	10	0	,,	,,

Standard Tin (Cash).

	£	s.	d.		
Oct. 28	303	15	0	dec.	55/-
,, 29	295	10	0	,,	165/-
Nov. 1	293	10	0	,,	40/-
,, 2	297	5	0	inc.	75/-
,, 3	300	0	0	,,	55/-

Tin (English ingots).

	£	s.	d.		
Oct. 28	302	0	0	dec.	5/-
,, 29	294	0	0	,,	160/-
Nov. 1	292	0	0	,,	40/-
,, 2	295	10	0	inc.	70/-
,, 3	298	0	0	,,	50/-

Zinc Sheets (English).

	£	s.	d.		
Oct. 28	42	15	0	No change	
,, 29	42	15	0	,,	,,
Nov. 1	42	10	0	dec.	5/-
,, 2	42	10	0	No change	
,, 3	42	10	0	,,	,,

Spelter (ordinary).

	£	s.	d.		
Oct. 28	34	2	6	inc.	2/6
,, 29	34	1	3	dec.	1/3
Nov. 1	33	12	6	,,	8/9
,, 2	33	8	9	,,	3/9
,, 3	33	10	0	inc.	1/3

Lead (English).

	£	s.	d.		
Oct. 28	31	15	0	No change	
,, 29	31	15	0	,,	,,
Nov. 1	30	15	0	dec.	20/-
,, 2	31	0	0	inc.	5/-
,, 3	31½	0	0	No change	

AVERAGE MONTHLY PRICES OF MARKED BARS (SOUTH STAFFS).

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1897	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0
1898	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	8 0 0	8 0 0	7 11 8
1899	8 0 0	8 0 0	8 0 0	8 0 0	8 10 0	8 10 0	9 0 0	9 10 0	9 10 0	10 0 0	10 0 0	10 0 0	8 3 4
1900	11 0 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 5 10
1901	9 10 0	9 10 0	9 10 0	9 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 16 8
1902	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 7 6
1903	8 5 0	8 5 0	8 5 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 8 9
1904	8 10 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 10
1905	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 10 0	8 10 0	8 1 8
1906	8 10 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	8 10 0	8 10 0	8 10 0	8 10 0	9 0 0	8 15 10
1907	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0
1908	9 0 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 5 10
1909	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0
1910	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0
1911	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0
1912	8 10 0	8 10 0	8 10 0	8 15 0	9 0 0	9 0 0	9 0 0	9 8 0	9 10 0	0 10 0	9 10 0	9 15 0	9 1 6
1913	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	9 10 0	9 10 0	9 4 0	9 0 0	9 0 0	9 13 8
1914	8 12 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	8 14 4
1915	9 0 0	9 0 0	9 3 0	10 2 0	10 15 0	11 10 0	12 0 0	12 0 0	12 0 0	12 7 6	12 10 0	13 10 0	11 5 0
1916	13 10 0	13 10 0	14 13 0	15 0 0	15 0 0	15 0 0	15 0 0	15 10 0	15 10 0	15 0 0	15 10 0	15 0 0	14 18 7
1917	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0
1918	15 12 6	16 0 0	16 0 0	16 0 0	16 0 0	16 0 0	16 0 0	16 0 0	16 0 0	17 0 0	17 0 0	17 0 0	16 6 3
1919	18 0 0	18 10 0	20 0 0	20 0 0	23 0 0	23 0 0	23 0 0	24 12 0	25 0 0	25 0 0	25 0 0	25 5 0	22 10 7
1920	26 17 6	27 0 0	28 0 0	30 5 0	30 10 0	33 10 0	33 10 0	33 10 0	33 10 0	33 10 0	33 10 0	33 10 0	31 10 2
1921	31 10 0	30 3 4	27 10 0	27 10 0	24 15 0	21 0 0	20 0 0	20 0 0	17 10 0	17 0 0	16 0 0	23 7 4	
1922	16 0 0	14 17 6	14 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 18 1½
1923	13 10 0	13 10 0	13 16 0	14 7 6	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 5 3½
1924	14 10 0	14 10 0	14 10 0	15 0 0	15 0 0	15 0 0	15 0 0	15 0 0	15 0 0	15 0 0	15 0 0	14 17 6	14 17 3½
1925	15 0 0	15 0 0	15 0 0	15 0 0	15 0 0	14 10 0	14 10 0	14 0 0	14 10 0	14 10 0	14 10 0	14 0 0	14 13 4
1926	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	—	—	14 0 0

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